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The Fundamentals of Electromagnetism

IT is a sign of the times and an indication of the change that has taken place in the approach to the study of electromagnetism, to open a book with the above title and find, on turning over the pages, that, except for a footnote on p. 76, the magnetic force *H* is first mentioned on p. 160, but this is actually the case in Professor Cullwick's new edition of his book,* as it was also in the first edition in 1939. A new edition of this thought-provoking book is very welcome, although, as the author explains, owing to his prolonged absence from academic work, changes in the present edition are few, except for the correction of inaccuracies, the clarification of some points, and removal of 'various appendages of doubtful value.' We trust that in his new position as Professor at University College, Dundee, he will be able to devote himself more whole-heartedly to such academic pursuits.

When the author speaks of lines of force, he means lines of magnetic induction, and says that he is adhering to Faraday's original use of the term, and that "the viewpoint taken in this book is that *H* is merely a certain measure of the flux-density called the m.m.f. gradient." We fear that a student will find this very confusing. Surely one can only have a gradient of a scalar quantity that has a definite value at any point. One cannot define the m.m.f. at a point, and therefore one cannot measure its gradient. The author treated the electric field in the same way in the first edition, but, although it still figures in the index as 'e.m.f. gradient', we are pleased to see that it has been deleted from the text.

The confusion of *H* and *B* is very unfortunate. Although mathematicians of a certain type may dislike analogies, they are very helpful in enabling a student to visualize abstract phenomena and magnitudes. He has been familiar from childhood with mass, weight, force and movement, and has no difficulty in understanding the extension of a test specimen when subjected to a force or load, nor the obvious next step, the distribution of the total applied force over the cross-section to obtain the localized cause or stress which is pictured as producing the strain at any point. The student to whom this is familiar will find no difficulty in following a similar procedure in the case of the magnetic circuit. The prime cause is a number of ampere-turns, which produces a magnetic flux around the circuit. Just as the force was divided over the area, to find the stress at any point in pounds per square inch, so the ampere-turns or m.m.f. can be divided over the length of the path, to find the localized cause or magnetic force at any point in ampere-turns per metre or per centimetre. This we designate by *H* and regard as the localized cause of the magnetic induction *B* at the point, just as the stress is regarded as the localized cause of the strain. Similarly the e.m.f., which is the prime cause of the current or displacement in an electric circuit, can be divided over the length of the electric circuit or path to obtain the localized cause or electric force $\mathcal{E}$ at any point. One may question the real existence of the stress or of *H* or $\mathcal{E}$, but it is in each case the quotient of two very real things.

We do not suggest that there is any physical analogy between the various phenomena, but we do maintain that the parallel methods of approach and similarity of treatment are very helpful. To insist on referring to lines of magnetic induction as lines of force because Faraday in those far-off days did not distinguish clearly between them, is a strange procedure, which can only cause confusion or uncertainty in the mind of the student.

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* "The Fundamentals of Electromagnetism", by E. G. Cullwick. Pp. 327 + xxvi with 139 illustrations. Cambridge University Press. Price 18s.

Clerk Maxwell is not treated quite so respectfully, for when he introduced and defined electric displacement he wrote "the displacement through a given surface is the quantity which passes through it" and "At the beginning of each unit tube of displacement there is a unit of positive electricity, and at the end of the tube there is a unit of negative electricity." This is, however, far too simple and 'rational' for Professor Cullwick, who introduces his own unit tube and on p. 10 states that "A tube of unit displacement thus has its origin on a charge of value $1/4\pi$ and terminates (as will be proved later) on a charge of equal value but of opposite sign." In a footnote is is stated that in rationalized units, the total displacement from a charge q is equal to q, but this was true of the concept as introduced and defined by Maxwell before rationalized units had been thought of. The author says "The part played by the vector D in the romantic development of electrical science is one of the first magnitude, but whether it is a concept which must be retained, or whether it will come to be regarded in the same light as a distinguished servant who, after work of supreme value, is now honourably retired from active service, is an interesting question." We feel that the author would have treated him more honourably if he had not distorted him with the irrational $1/4\pi$. The author's object in derationalizing D was apparently to be able to write $D = \kappa_0\mathcal{E}$, in keeping with $B = \mu_0 H$, instead of the Maxwellian $4\pi D = \kappa_0\mathcal{E}$. This treatment of displacement is also contrary to the B.S.I. Glossary.

On the cover of the book it states that it is unorthodox and original in method, designed to encourage its readers to think freshly. After a foreword on units and formulae there are five chapters; the first deals with the electrostatic field and the electric current, the second with the magnetic field and electromagnetic induction, the third with the magnetic field of the electric current, the fourth with ferromagnetism and permanent magnets, and the fifth with electromagnetic waves and vector potential. After each chapter there is a number of exercises, some of which are worked out and discussed at length and form a valuable addition to the text. There is a prologue and an epilogue, both well worth reading. In the former the author says "It appears to me that a problem of supreme importance now faces all teachers of electrical engineering (and of the preparatory physics courses), a problem whose solution necessitates a radical change of viewpoint, and methods of presenting the fundamentals of electricity and magnetism." . . . "This book has been written with the aim of making some contribution, however imperfect, to the solution of this problem. The concluding sentence of the epilogue is "If we lose a comfortable but blinding faith we gain, one may hope, a humble open-mindedness which should prepare us to welcome, as they are uncovered, new fragments of the truth."

G. W. O. H.

The Intrinsic Impedance of Space

Professor Constantinescu of Bucharest has called our attention to an ambiguity in the September Editorial. In referring to a spherical surface we used the terms latitudinal distance and longitudinal distance; by the former we meant distance measured along a line of latitude, and by the latter, distance measured along a line of longitude. Since, however, latitude is measured from the equator towards the poles, that is, along a line of longitude, the terms are certainly somewhat ambiguous, and it would be better to say more definitely that the distances are measured along the lines of latitude or longitude.

G. W. O. H.

LOW-DISTORTION POWER VALVES

By G. Diemer and J. L. H. Jonker

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SUMMARY.—A survey is given of various low-distortion valve constructions. Two new constructions are described by means of which the second harmonic of a single-stage class-A pentode amplifier can be considerably reduced, resulting in a reduction of the total distortion by a factor of 2 up to an output of about 25% of the static anode dissipation. For large outputs (up to 50% of the static anode dissipation) the distortion is the same as that of a normal valve. The new valves have an I_a–V_g characteristic that is practically linear in the neighbourhood of the normal operating point.

1. Introduction

IN the course of valve development many attempts have been made to lower the distortion which is especially liable to arise in the last stage of audio-frequency amplifiers.

In 1937 Kleen[1] gave a survey of the results that had been obtained up to that date by various methods. The aim of this article is to give a somewhat more extensive survey including some new results obtained since 1937, while two different methods that have been studied in more detail by the present authors will be discussed.

Negative feedback is one well-known measure for reducing distortion, but negative feedback causes a serious decrease of the effective mutual conductance. In the following we shall confine ourselves, therefore, to special valve constructions which give low distortion in the valve itself. We, therefore, start with an analysis of the different causes contributing to the non-linearity of the valve characteristic. Only tetrodes and pentodes will be dealt with because these valves have the highest efficiency.

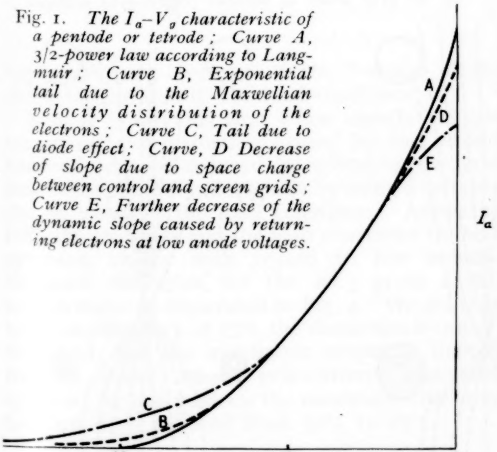

Fig. 1. *The I_a–V_g characteristic of a pentode or tetrode; Curve A, 3/2-power law according to Langmuir; Curve B, Exponential tail due to the Maxwellian velocity distribution of the electrons; Curve C, Tail due to diode effect; Curve, D Decrease of slope due to space charge between control and screen grids; Curve E, Further decrease of the dynamic slope caused by returning electrons at low anode voltages.*

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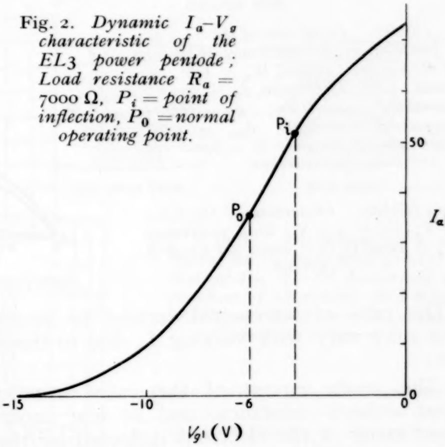


Fig. 2. *Dynamic I_a–V_g characteristic of the EL3 power pentode; Load resistance R_a = 7000 Ω, P_i = point of inflection, P_0 = normal operating point.*

2. The I_a-V_g Characteristic

The I_a–V_g characteristic of a tetrode or a pentode is governed mainly by Langmuir's 3/2-power law (curve A in Fig. 1). This law is valid when

1. The initial velocities of the electrons are negligible.

2. The electric field at the cathode surface is homogeneous.

3. Space charge between the control grid and the screen grid plays no important part, and

4. The ratio of screen-grid current to anode current is independent of the anode current.

Since these four conditions are not fulfilled in practice, deviations from the 3/2-power law occur due to the following causes:

1. Because of the Maxwellian velocity distribution of the emitted electrons, for small values of I_a the I_a–V_g characteristic is exponential (curve B).

2. In high-slope power valves the latter deviation, however, is negligible in comparison to that caused by the inhomogeneity of the field strength at the cathode surface (i.e., the so-called diode effect, curve C). To get a high value of the anode

current as well as of the mutual conductance the distance between the cathode and the control grid is made equal to the pitch of that grid or even smaller. For such dimensions the electron emission in the region between the wires of the grid can only be suppressed by very large negative grid voltages.

3. In some cases, especially with large values of anode current and distance between control and screen grids the space charge in this region causes a decrease of the slope (curve D).

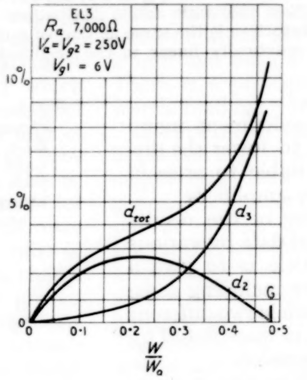


Fig. 3 (left). Distortion of the EL3 as a function of the efficiency W/W_0; W *= dynamic output,* $W_0 = I_a V_a$ *= static anode dissipation,* d_2 *= second harmonic distortion,* d_3 *= third-harmonic distortion,* d_{tot} *= total harmonic distortion, G = limit set by grid current.*

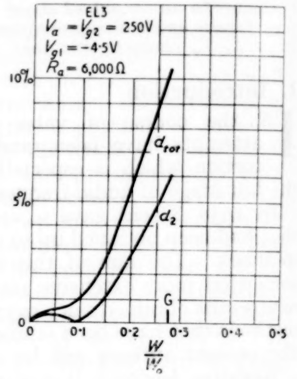


Fig. 4 (right). *Distortion of the EL3 at* $V_{g1} = -4·5$ V; *load resistance* $R_a = 6000\ \Omega$, *G = limit set by grid current.*

4. The ratio of screen-grid current to anode current may vary with varying I_a due to three causes:

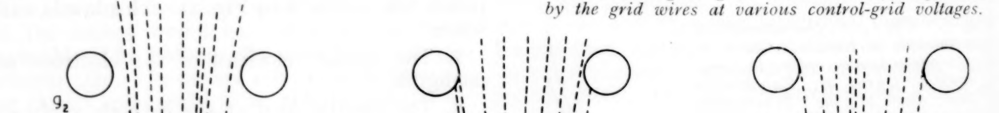
(a) The anode circuit of the valve usually contains a load resistance, and at low anode voltages many of the electrons deflected by the grid wires cannot reach the anode and return to the screen grid, so that another deviation from the dynamic characteristic occurs (curve E).

(b) The influence of the space charge between the screen grid and the anode may result in a deviation similar to curve E.

(c) Valves in which the control grid and screen grid are 'lined up' may show a variation in the relative number of electrons intercepted by the screen grid, because of the variation in electron focusing by the control grid.[13] This effect will be discussed in detail in Section 4, as it has provided us with a possibility of reducing the distortion.

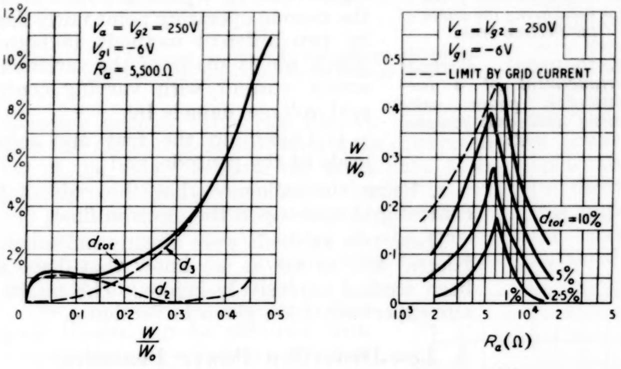
It is not our aim to give a full list of all the effects contributing to valve distortion, and we have only mentioned the phenomena that are important in our investigations. The influence of secondary emission at the anode has already

Fig. 5. *Cross section of a low-distortion power valve with aligned grids. Electron beams formed by the grid wires at various control-grid voltages.*



been discussed in detail by Jonker and Heins van der Ven,[2,14] so it will not be discussed here.

As an example of a normal dynamic pentode characteristic, in which most of the effects mentioned above are present, Fig. 2 shows the dynamic I_a–V_g characteristic of the EL3 pentode. As may be seen, the point of inflection caused by the load resistance lies at about $V_{g1} = -4.5$ V, while the normal grid bias for this valve is $V_{g1} = -6$ V. Thus for normal grid bias we shall have, when the signal voltages are not too large, a dynamic characteristic showing on the average a curvature which results in considerable second-harmonic distortion in the output.* This may also be seen from Fig. 3, where for the EL3 the distortion is given as a function of the efficiency W/W_0 under normal operating conditions (W = output of the valve, $W_0 = I_aV_a$ = static anode dissipation). With strong signals ($W/W_0 \approx 0.5$) the third harmonic begins to play the most important part, because of the S-shape of the characteristic due to the load resistance.



(a) (b)

Fig. 6 (left). *Distortion of a valve having an electrode arrangement like that of Fig. 5. (a) Distortion as a function of efficiency; (b) Efficiency W/W_0 as a function of R_a at various constant values of d_{tot}.*

Now it is obvious that when signals are not too strong the distortion caused by the second harmonic can be reduced by adjusting the grid bias to the point of inflection or by using a suitably chosen value of the load resistance. Adjusting both the grid bias and the load resistance to their optimum values with regard to low second-harmonic distortion for the EL3 gives a distortion curve as illustrated in Fig. 4. We see that up to an efficiency of 15% the distortion is indeed improved, but the maximum output is limited by the point where grid-current distortion appears ; for this pentode the maximum efficiency has thus been reduced from 50% to 25%.

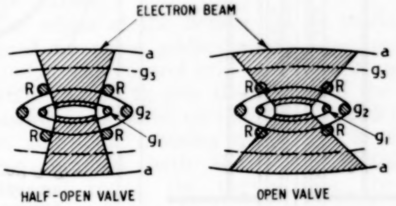
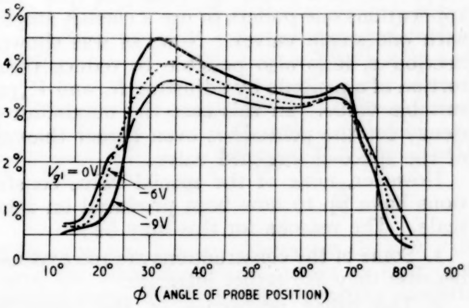


Fig. 7 (above). *Electron beams formed by the rods of the control grid at different values of the control-grid voltage.*

Fig. 8 (below). *Width of the electron beams shown in Fig. 7, as measured by means of a movable probe (see Fig. 9).*



3. Older Low-Distortion Valve Constructions

In the course of time many proposals have been made for reducing the distortion by special electrode constructions. Attempts have been made to improve the tail of the characteristic by the electron-optical focusing of surplus current on an auxiliary electrode.[3] It has been proposed to reduce the curvature for large values of I_a by using simultaneously two different control grids, [1, 4] by using a deflection electrode together with a special form of the output anode,[5] by using the partition of the cathode current by a specially shaped grid and a plate[6] or by the influence of space charge.[7] Recently Brian[8] and Pickering[9] have published results obtained when using a tetrode with a positive first grid (space-charge grid). Although their construction seems to us the most useful hitherto published, we wish to make the following remark. The maximum efficiency of their valve is much lower than that of a pentode, especially when the valves are not used in push-pull (for many applications one prefers to use a class-A amplifier with one single valve). Now, as was shown in Section 2, it is also possible to reduce the distortion of a pentode by adjusting R_a and V_{g1} to a suitable value. In this case the maximum efficiency for the pentode is even higher than that of the space-charge-grid valve.

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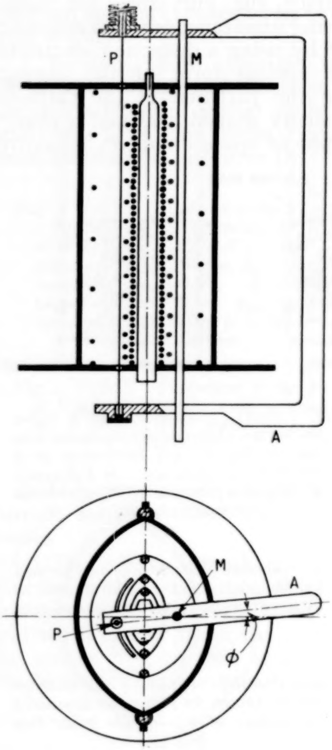
* For a good comparison we used experimental EL3 pentodes that were made at the same time as the low-distortion pentodes to be discussed in Section 4. The EL3 characteristics given here, therefore, show small deviations from the EL3 characteristics normally published.



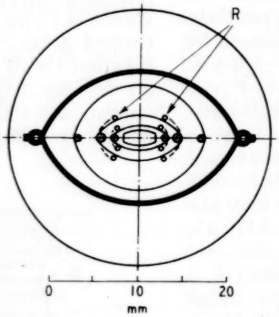


Fig. 9 (left). *Construction of an experimental valve containing a movable probe P for measuring the width of the electron beam.*

Fig. 10 (right). *Electrode arrangement of a low-distortion power valve using additional focusing rods.*

However, none of the special valve constructions have up to now been produced on a large scale. The reasons for this may be :

1. Some of the constructions are too expensive, because they are rather intricate.

2. The other properties of the valve (e.g. maximum efficiency, mutual conductance, internal resistance) are sometimes worse than those of the normal valve.

3. In some cases the decrease of distortion depends too much upon the value and phase angle of the load impedance.

Still a low-distortion power valve with other characteristics normal is always attractive, because a smaller amount of feedback is required, resulting in a higher value of the mutual conductance, and difficulties resulting from the frequency-dependence of the feedback are less serious.

We have, therefore, investigated the problem from a different angle, trying only to avoid curvature of the dynamic characteristic in the neighbourhood of the normal operating point leaving the tail, caused by diode effect, and the upper curvature, caused by the presence of the load resistance, as they are. It is our conviction that it is not possible to improve the latter appreciably when only simple electrode constructions are used.

We have succeeded in making the region of the I_a–V_g characteristic around the normal operating point fairly linear by two different methods, in both of which use is made of the variation in screen current with varying control-grid voltage, namely by

1. Lining up the first and second grids of the pentode, and

2. Using the influence that the rods of the control grid have upon the electron flow.

These two methods were already indicated by Kleen,[1] but as far as we know they have not been studied extensively before. The results of our experiments are given in Section 4.

4. Low-Distortion Power Pentodes

It is well known that the wires of the control grid in a normal valve divide the electron current into several flat beams which cross over somewhere beyond the grid plane (see e.g., Knoll and others[10, 11], and Jonker [2, 12]).

In Fig. 5 a cross-section is given of a valve in which the wires of the control and screen grids are lined up. The shape of the electron beams formed by the wires of the control grid, as photographed from large-scale models on a rubber sheet, are also drawn for three different control-grid voltages ; viz, strongly negative, near the operating point, and slightly negative. From extensive experiments on the rubber sheet with various grid dimensions we concluded that for suitable dimensions of the screen grid it is possible to intercept a varying part of the beams by the combined action of the focus displacement and the variation in aperture of the electron beams at different control-grid voltages.

For our purpose the dimensions were chosen so that the interception was the maximum at a grid voltage somewhat less negative than the normal operating point.

These experiments with the help of models on the rubber sheet have led to a pentode construction very closely resembling the EL3, and showing much less distortion than the corresponding normal valve (see Fig. 6). Of course with this method there are limits in the dimensioning of the valve, because the grids have to be lined up, and for a given construction of the control grid and a given distance between the control and screen grids the diameter of the screen-grid wires is fixed, on account of the conditions set by the interception effect.

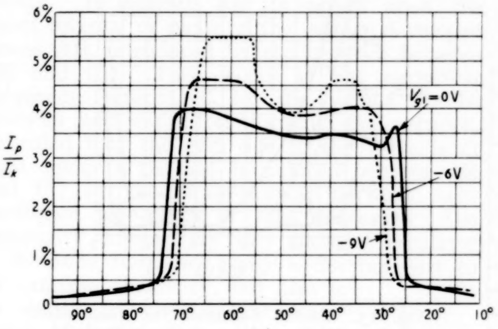
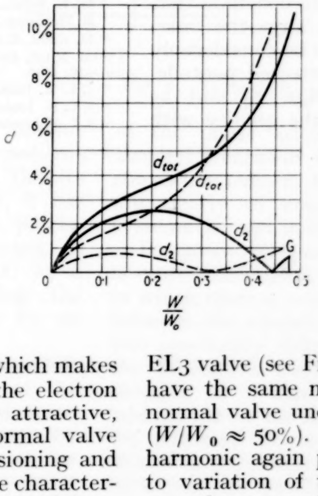


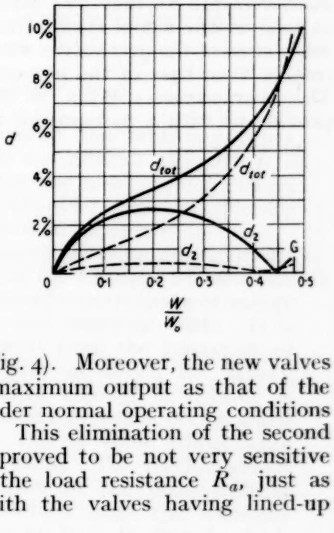
Fig. 11. *The same as Fig. 8, but using additional focusing rods connected to the control grid.*

The experiments indicated that good results can be obtained with various distances between the two grids provided the wire diameters are suitably chosen.

Fig. 12 (left). *Distortion with a valve construction like that of Fig. 7 as a function of the efficiency* W/W_0*; G = limit set by grid current. Solid line curves for EL3, dotted for low-distortion valve of Fig. 10;* $V_a = V_{g2} = 250$ V, $V_{g1} = -6$ V, $R_a = 7{,}000\ \Omega$.

Fig. 13 (right). *The same as Fig. 12 but with additional focusing rods.*





The second method we developed, which makes use of the variation in aperture of the electron beams, seems, however, much more attractive, because it can be applied to any normal valve without any variation of grid dimensioning and with only a slight variation of the valve characteristics. The idea may be easily understood from Fig. 7. The electron stream is divided by the negatively-charged rods of the control grid into two beams, the width of which decrease as a function of the control-grid voltage.

Fig. 8 shows the intensity of the beam at various places as measured by means of a probe (experimental valve, see Fig. 9). Now a variable amount of the anode current can be intercepted by placing auxiliary positive electrodes of a suitable form near the edge of the electron beams. For our purpose it proved to be sufficient to use cylindrical rods (R) of 0.3 mm diameter (see Fig. 7). The best position for these rods was determined from the measurements with the probe valves.

The edges of the beams can be made better defined by using additional focusing rods connected to the control grid (see Figs. 10 and 11).

Figs. 12 and 13 give the results of the output measurements taken on the latter valves (Fig. 13 with additional focusing rods). The best results were obtained with the valves fitted with additional rods; the curves give the mean values for five valves. The spread in the distortion of the individual valves was not very great (of the order of 20%). The tolerances in the positions and the shape of the intercepting rods are of the same order of magnitude as the tolerances in normal cathode-grid constructions of power pentodes. We see that for an output up to about half of the maximum useful output the distortion is reduced by about a factor of 2 this improvement being due to the absence of the second harmonic. This is more than was obtained by varying the grid bias of a normal EL3 valve (see Fig. 4). Moreover, the new valves have the same maximum output as that of the normal valve under normal operating conditions ($W/W_0 \approx 50\%$). This elimination of the second harmonic again proved to be not very sensitive to variation of the load resistance R_a, just as was the case with the valves having lined-up grids.

Finally Fig. 14 gives the slope of the dynamic

I_a–V_g characteristic for a normal pentode EL3 and for a low-distortion valve according to Fig. 10. We see that for the low-distortion valve the slope is almost constant within a large voltage region around the normal operating point. The same may be concluded from Fig. 15, where the second-and third-harmonic distortion for small signal ($V \approx 0.2$Vr.m.s.) as a function of grid bias are given for the same valves. From these

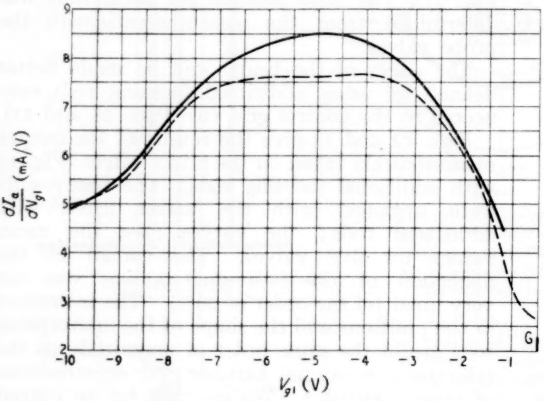


Fig. 14. *Slope of the dynamic I_a–V_g characteristic as a function of V_{g1} for a normal pentode EL3 and for a low-distortion pentode like that of Fig. 10. G = limit set by grid current. Solid line curves for EL3, dotted for low-distortion valve of Fig. 10;* $V_a = V_{g2} = 250$ V, $V_{g1} = -6$ V, $R_a = 7{,}000\ \Omega$.

measurements we may also safely conclude that as long as the signal is not too large the *intermodulation* of the new valves will be considerably smaller than that of the non-corrected pentode. The characteristics given in Figs. 14 and 15 provide us with a measure for the quality with regard to both distortion and intermodulation independently of the frequencies for which the valve may be used.

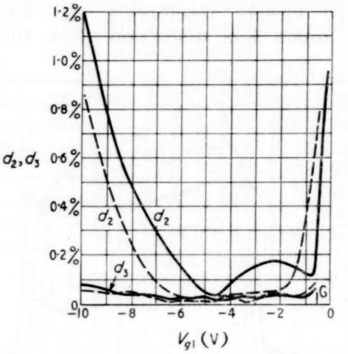


Fig. 15. *Second harmonic for small input voltage ($V \approx 0.2$ V r.m.s.) as a function of V_{g1} for the EL3 and for a low-distortion pentode. Solid line curves for EL3, dotted for low-distortion valve of Fig. 10;* $V_a = V_{g2} = 250$ V, $V_{g1} = -6$ V, $R_a = 7{,}000\ \Omega$.

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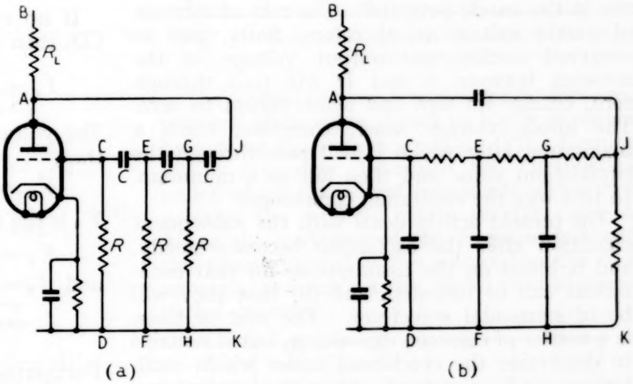
PHASE-SHIFT OSCILLATOR

By W. C. Vaughan, M.B.E., B.Sc., Ph.D., A.M.I.E.E.

THE type of oscillator of which examples are shown in Figs. 1 (a) and (b) is in widespread use as an audio-frequency source. It depends for its action upon the exact reversal of phase of the voltage developed across AB, introduced by the network between JK and CD. This occurs at one particular frequency determined by the values of the resistors and capacitors forming the network. Provided that the gain due to the valve is at least equal to the loss introduced between JK and CD by the phase-shifting network, self-oscillation will occur at this frequency. The popularity enjoyed by this class of oscillator in the audio-frequency range is due not only to its extreme simplicity, but also to an ability to give output waveforms of better shape than those from conventional LC circuits, and the fact that its frequency stability is at least as good as that of the beat-frequency oscillator.

In some instances, four-mesh networks are used for phase shifting, and a fair range of frequency variation is possible with both these and the three-mesh arrangements merely by making one of the components of the network variable. The phase of the voltage across AB is advanced 180° by the type of network shown in Fig. 1 (a), while that employed in Fig. 1 (b) introduces an equal phase retardation. For fixed-frequency working, it is usual to employ uniform networks in which all the resistors and all the capacitors have equal values. Despite their comparatively simple construction, it has been the writer's experience that the precise behaviour of the phase-shifting network is rarely completely understood and that, as a result, serious misconceptions regarding the design of these types of oscillator are by no means uncommon.

In elementary descriptions of the phase-shift oscillator, it is often stated that each of the elements of the three-mesh network advances or retards the phase of the applied voltage by 60°. It is also frequently assumed that at the frequency at which the network causes exact phase reversal, the input impedance of the arrangement is a pure resistance, and that the possibilities of frequency variation are restricted because only a uniform network can bring about exact phase reversal. Furthermore, in the case of uniform networks, the frequency of oscillation is sometimes quoted as the reciprocal of the time constant of the CR element. All these views are fallacious and militate against the design of phase-shift oscillators for specific purposes. Clear understanding of the behaviour of the arrangement in any of its forms can only come from a detailed study of the circumstances under which the phase-shifting network can introduce exact voltage reversal, and it is the purpose of this article to examine this problem in the case of three- and four-mesh networks of the phase advancing and retarding types. General treatment is not difficult although it is somewhat tedious, but the results which emerge are clearly of considerable value in devising systems to meet individual requirements.



(a) (b)

Fig. 1. *Typical RC-oscillator circuits.*

The mode of operation of these arrangements is quite unlike that of the LC type of oscillator in which there is a periodic interchange of energy between the electric and magnetic fields. It is also essentially different from the behaviour of the relaxation oscillator in which the steady charging of a capacitor through a resistor is interrupted by the instability which occurs when the potential across one of these components attains a particular value. The mechanism of initiating the oscillation in the phase-shifting circuit has been described from the transient standpoint in a paper by P. G. M. Dawe[1], which

MS accepted by the Editor, March 1949

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[1] P. G. M. Dawe, *Engineering*, Oct. 1947, Vol. 164, pp. 429–432.

shows that the initial charging and subsequent discharging of the capacitors as the result of the application of a voltage step, produces overswing effects which give, at the output of the network, voltage reversals similar to a heavily damped oscillation. If a steadily rising voltage is applied to the system, the output voltage falls to zero, changes its sign, and again returns to zero.

This account, which gave a qualitative and quantitative treatment of the transient condition before steady oscillations ensue, pointed out that if the h.t. supply to the circuit shown in Fig. 1 (a) is a voltage step, the anode-cathode potential difference is unable to rise immediately to its final value because of the heavy positive feedback due to the capacitors. The static value is not, in fact, reached until the grid capacitor is fully charged, but this at once commences to discharge and produces a further rise in the anode potential. The rate of increase of anode voltage is, therefore, finite, and as observed earlier, the output voltage of the network between C and D will pass through zero, change its sign and again return to zero. The anode voltage must, therefore, reach a maximum, after which it will pass through the equilibrium value and then fall to a minimum. In this way the oscillation commences.

The present article deals with the subsequent condition after the oscillation becomes steady, and is based on the assumptions (a) that oscillations can be initiated, and (b) that they will be of sinusoidal waveform. The first of these is a matter of common experience, but it remains to determine the conditions under which oscillations can be sustained. Since the network can give phase reversal for one frequency only, the second assumption is plausible.

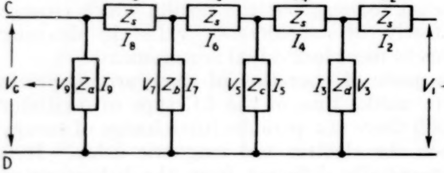


Fig. 2. *Generalized four-mesh network for shunt variable element.*

For the purposes of this investigation, it will be assumed that the load resistance R_L connected between A and B in Figs. 1 (a) and (b) is substantially smaller than the input impedance of the network measured between J and K. As a result, the currents set up in the components of the various meshes may be regarded as due to an alternator of voltage V_L, frequency $f = \omega/2\pi$, and negligibly low internal impedance. A single general solution for the voltage and current distributions about a four-mesh network involves very unwieldy expressions, so that two forms of generalized network will be considered. In the first instance, the four-mesh network shown in Fig. 2, having identical series elements Z_s, but different shunt impedances Z_a, Z_b, Z_c, Z_d, will be examined. The impedance expressions appearing in the following analysis may, of course, be real, imaginary, or complex, and it is the aim to determine the voltages V_9, V_8, ...V_1 across the components, and the currents I_9, I_8, ... I_2 through these, in terms of the applied voltage V_L. The procedure is somewhat more straightforward if these quantities are determined in terms of the output voltage V_G which the network applies between the grid and cathode of the valve.

If no current is taken from the network at CD, then the current I_8 is equal to I_9, so that

$$I_8 = I_9 = \frac{V_9}{Z_a} = \frac{V_G}{Z_a} \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

The voltage V_8 is the product of I_8 and Z_s, so that,

$$V_8 = I_8 Z_s = V_G Z_s/Z_a \quad \ldots \quad \ldots \quad (2)$$

V_7 is the sum of V_8 and V_9, hence,

$$V_7 = V_G [1 + Z_s/Z_a] \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

and $I_7 = V_7/Z_b$

$$= V_G \left[\frac{Z_s}{Z_a Z_b} + \frac{1}{Z_b}\right] \quad \ldots \quad \ldots \quad (4)$$

Furthermore, the current I_6 is the sum of I_7 and I_8, so that,

$$I_6 = V_G \left[\frac{Z_s}{Z_a Z_b} + \frac{1}{Z_a} + \frac{1}{Z_b}\right] \quad \ldots \quad \ldots \quad (5)$$

Proceeding thus, it is possible to write down successively the values of voltage and current for each component in the network. Thus,

$$V_6 = I_6 Z_s$$

$$= V_G \left[\frac{Z_s^2}{Z_a Z_b} + Z_s\left(\frac{1}{Z_a} + \frac{1}{Z_b}\right)\right] \quad \ldots \quad (6)$$

$$V_5 = V_6 + V_7$$

$$= V_G \left[\frac{Z_s^2}{Z_a Z_b} + Z_s\left(\frac{2}{Z_a} + \frac{1}{Z_b}\right) + 1\right] \quad \ldots \quad (7)$$

$$I_5 = \frac{V_5}{Z_c}$$

$$= V_G \left[\frac{Z_s^2}{Z_a Z_b Z_c} + Z_s\left(\frac{2}{Z_a Z_c} + \frac{1}{Z_b Z_c}\right) + \frac{1}{Z_c}\right] \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (8)$$

$$\begin{aligned}
I_4 &= I_5 + I_6 \\
&= V_G\Big[\frac{Z_s^2}{Z_a Z_b Z_c} + Z_s\Big(\frac{1}{Z_a Z_b} + \frac{2}{Z_a Z_c} \\
&\quad + \frac{1}{Z_b Z_c}\Big) + \frac{1}{Z_a} + \frac{1}{Z_b} + \frac{1}{Z_c}\Big] \quad \ldots \quad (9)
\end{aligned}$$

$$\begin{aligned}
V_4 &= I_4 Z_s \\
&= V_G\Big[\frac{Z_s^3}{Z_a Z_b Z_c} + Z_s^2\Big(\frac{1}{Z_a Z_b} + \frac{2}{Z_a Z_c} \\
&\quad + \frac{1}{Z_b Z_c}\Big) + Z_s\Big(\frac{1}{Z_a} + \frac{1}{Z_b} + \frac{1}{Z_c}\Big)\Big] \quad \ldots \quad (10)
\end{aligned}$$

$$\begin{aligned}
V_3 &= V_4 + V_5 \\
&= V_G\Big[\frac{Z_s^3}{Z_a Z_b Z_c} + Z_s^2\Big(\frac{2}{Z_a Z_b} + \frac{2}{Z_a Z_c} \\
&\quad + \frac{}{Z_b Z_c}\Big) + Z_s\Big(\frac{3}{Z_a} + \frac{2}{Z_b} + \frac{1}{Z_c}\Big) + 1\Big] \quad (11)
\end{aligned}$$

$$\begin{aligned}
I_3 &= \frac{V_3}{Z_d} \\
&= V_G\Big[\frac{Z_s^3}{Z_a Z_b Z_c Z_d} + Z_s^2\Big(\frac{2}{Z_a Z_b Z_d} \\
&\quad + \frac{2}{Z_a Z_c Z_d} + \frac{1}{Z_b Z_c Z_d}\Big) + Z_s\Big(\frac{3}{Z_a Z_d} \\
&\quad + \frac{2}{Z_b Z_d} + \frac{1}{Z_c Z_d}\Big) + \frac{1}{Z_d}\Big] \quad \ldots \quad (12)
\end{aligned}$$

$$\begin{aligned}
I_2 &= I_3 + I_4 \\
&= V_G\Big[\frac{Z_s^3}{Z_a Z_b Z_c Z_d} + Z_s^2\Big(\frac{1}{Z_a Z_b Z_c} \\
&\quad + \frac{2}{Z_a Z_b Z_d} + \frac{2}{Z_a Z_c Z_d} + \frac{1}{Z_b Z_c Z_d}\Big) \\
&\quad + Z_s\Big(\frac{1}{Z_a Z_b} + \frac{2}{Z_a Z_c} + \frac{3}{Z_a Z_d} + \frac{1}{Z_b Z_c} \\
&\quad + \frac{2}{Z_b Z_d} + \frac{1}{Z_c Z_d}\Big) + \frac{1}{Z_a} + \frac{1}{Z_b} \\
&\quad + \frac{1}{Z_c} + \frac{1}{Z_d}\Big] \quad \ldots \quad \ldots \quad (13)
\end{aligned}$$

$$\begin{aligned}
V_2 &= I_2 Z_s \\
&= V_G\Big[\frac{Z_s^4}{Z_a Z_b Z_c Z_d} + Z_s^3\Big(\frac{1}{Z_a Z_b Z_c} \\
&\quad + \frac{2}{Z_a Z_b Z_d} + \frac{2}{Z_a Z_c Z_d} + \frac{1}{Z_b Z_c Z_d}\Big) \\
&\quad + Z_s^2\Big(\frac{1}{Z_a Z_b} + \frac{2}{Z_a Z_c} + \frac{3}{Z_a Z_d} \\
&\quad + \frac{1}{Z_b Z_c} + \frac{2}{Z_b Z_d} + \frac{1}{Z_c Z_d}\Big) \\
&\quad + Z_s\Big(\frac{1}{Z_a} + \frac{1}{Z_b} + \frac{1}{Z_c} + \frac{1}{Z_d}\Big)\Big] \quad (14
\end{aligned}$$

$$\begin{aligned}
V_L &= V_1 = V_2 + V_3 \\
&= V_G\Big[\frac{Z_s^4}{Z_a Z_b Z_c Z_d} + Z_s^3\Big(\frac{2}{Z_a Z_b Z_c} \\
&\quad + \frac{2}{Z_a Z_b Z_d} + \frac{2}{Z_a Z_c Z_d} + \frac{1}{Z_b Z_c Z_d}\Big) \\
&\quad + Z_s^2\Big(\frac{3}{Z_a Z_b} + \frac{4}{Z_a Z_c} + \frac{3}{Z_a Z_d} \\
&\quad + \frac{2}{Z_b Z_c} + \frac{2}{Z_b Z_d} + \frac{1}{Z_c Z_d}\Big) \\
&\quad + Z_s\Big(\frac{4}{Z_a} + \frac{3}{Z_b} + \frac{2}{Z_c} + \frac{1}{Z_d}\Big) + 1\Big] \quad (15)
\end{aligned}$$

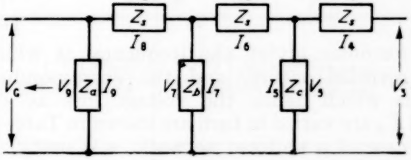


Fig. 3. *Generalized three-mesh network for shunt variable element.*

The corresponding relation for a three-mesh network of the type shown in Fig. 3 is obtained by putting $V_L' = V_3$ in equation (11). Equations (1) to (15) now determine the circumstances under which three- and four-mesh networks can produce the required phase reversal, and also define the variation of the frequency at which this occurs, as well as the voltage loss due to the network as each of its shunt impedances is varied in turn.

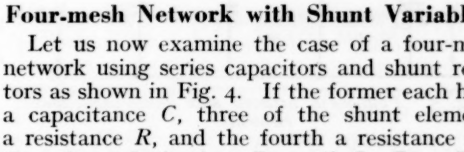


Fig. 4. *Four-mesh network with series-capacitance elements.*

Four-mesh Network with Shunt Variable

Let us now examine the case of a four-mesh network using series capacitors and shunt resistors as shown in Fig. 4. If the former each have a capacitance C, three of the shunt elements a resistance R, and the fourth a resistance nR, then by substituting $Z_s = 1/j\omega C$, $Z_b = Z_c = Z_d = R$, and $Z_a = nR$ in equation (15) we obtain,

$$\begin{aligned}
V_L = V_G\Big\{&\Big[1 + \frac{1}{\omega^4 C^4 n R^4} - \frac{1}{\omega^2 C^2 R^2}\Big(\frac{10}{n} + 5\Big)\Big] \\
&+ j\Big[\frac{1}{\omega^3 C^3 R^3}\Big(\frac{6}{n} + 1\Big) - \frac{1}{\omega C R}\Big(\frac{4}{n} + 1\Big)\Big]\Big\} \quad (16)
\end{aligned}$$

If V_G is to be in exact antiphase with V_L, the imaginary part of equation (16) must vanish, so that the frequency at which this occurs is given by,

$$\frac{1}{\omega^3C^3R^3}\left(\frac{6}{n}+1\right)=\frac{1}{\omega CR}\left(\frac{4}{n}+6\right)$$

whence,

$$f=\frac{1}{2\pi CR}\sqrt{\frac{6+n}{4+6n}} \quad \ldots \quad \ldots \quad \ldots \quad (17)$$

Substituting this result in equation (16) we obtain,

$$\frac{V_L}{V_G}=1+\frac{1}{n}\left[\left(\frac{4+6n}{6+n}\right)^2-\frac{4+6n}{4+n}(10+5n)\right] \quad \ldots \quad \ldots \quad \ldots \quad (18)$$

The formulae giving the frequency at which phase reversal occurs, and the corresponding relations which define the voltage loss as Z_b, Z_c, and Z_d are varied in turn are shown in Table I. In the case of a uniform network, n is unity, so that in this instance, the frequency at which the phase is advanced by 180° is given by $f=\frac{1}{2\pi CR}\sqrt{\frac{7}{10}}$ and the ratio of input to output voltage is $V_L/V_G=-18.4$. The negative sign indicates, of course, that the phase has been advanced by 180° and not 360°. Provided therefore that the valve is able to ensure a voltage gain of at least 18.4, self-oscillation will occur at a frequency $f=0.1331/CR$. It is worthy of note that in all cases, the voltage loss introduced by the network is independent of the individual values of C and R, although it must be remembered that unless R is considerably greater than the a.c. resistance r_a of the valve, it may be impossible to choose a sufficiently large value of R_L to secure the required amplification.

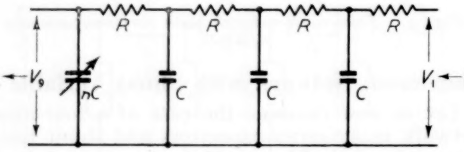


Fig. 5. *Four-mesh network with shunt-capacitance elements.*

The alternative case which we shall now consider is that in which the series components of the network are resistors of equal value R, and the shunt arms are capacitors as shown in Fig. 5. In this instance, suppose that $Z_a=1/j\omega nC$ $Z_b=Z_c=Z_d=1/j\omega C$, and $Z_s=R$. Equation (15) then gives the relation between input and output voltages as,

$$\begin{aligned}V_L=V_G[&\omega^4nC^4R^4-j\omega^3R^3(2nC^3+2nC^3\\&+2nC^3+C^3)\\&-\omega^2R^2(3nC^2+4nC^2+3nC^2\\&+2C^2+2C^2+C^2)\\&+j\omega R(4nC+3C+2C\\&+C)+1]\end{aligned}$$

$$\begin{aligned}V_L=V_G\{&[1+\omega^4nC^4R^4-\omega^2C^2R^2(10n+5)]\\&-j[\omega^3C^3R^3(6n+1)-\omega CR(4n+6)]\}\end{aligned} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (19)$$

Equating the imaginary part of this expression to zero, we find that exact phase reversal occurs at a frequency defined by,

$$f=\frac{1}{2\pi CR}\sqrt{\frac{4n+6}{6n+1}} \quad \ldots \quad \ldots \quad \ldots \quad (20)$$

and that the voltage loss due to the network is

$$\frac{V_L}{V_G}=1+n\left(\frac{4n+6}{6n+1}\right)^2-\frac{4n+6}{6n+1}(10n+5) \quad (21)$$

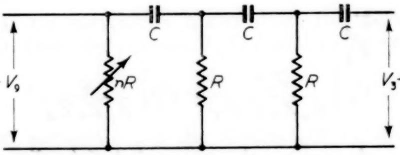


Fig. 6. *Three-mesh network with series-capacitance elements.*

For a uniform four-mesh network with resistive series components and capacitive shunt arms a phase retardation of 180° occurs at a frequency $f=\frac{1}{2\pi CR}\sqrt{\frac{10}{7}}=\frac{0.1902}{CR}$, the ratio of input to output voltage being 18.4 as before.

Three-mesh Network with Shunt Variable

Corresponding relations may be obtained for the three-mesh network shown in Fig. 6 by substituting $Z_s=1/j\omega C$, $Z_a=nR$, and $Z_b=$ $=Z_c=R$ in equation (11). It is then evident that,

$$V_L'=V_G\left\{\left[1-\frac{1}{\omega^2C^2R^2}\left(\frac{4}{n}+1\right)\right]+j\left[\frac{1}{\omega^3C^3nR^3}-\frac{1}{\omega CR}\left(\frac{3}{n}+3\right)\right]\right\} \quad (22)$$

The frequency at which the network provides exact phase reversal is obtained by equating the imaginary part of (22) to zero, whence,

$$f=\frac{1}{2\pi CR}\sqrt{\frac{1}{3+3n}} \quad \ldots \quad \ldots \quad \ldots \quad (23)$$

If this result is introduced into equation (22), the voltage loss due to the network is seen to be,

$$\frac{V_L'}{V_G}=-\left[14+\frac{12}{n}+3n\right] \quad \ldots \quad \ldots \quad (24)$$

For a uniform network, all the shunt components have identical resistances, so that the frequency at which a phase advance of 180° takes place is $f = \frac{1}{2\pi CR\sqrt{\frac{1}{6}}} = \frac{0.0649}{CR}$, the ratio of the input to output voltage then being $V_L'/V_G = -29$.

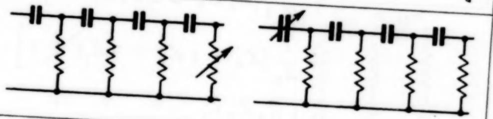
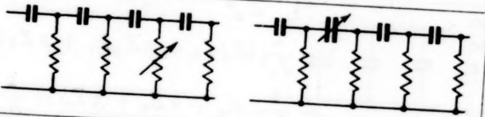
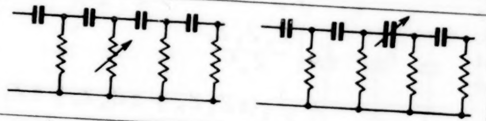
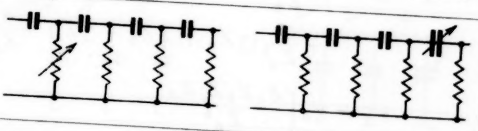
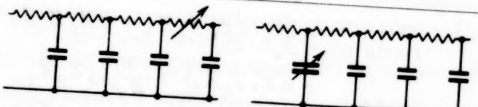
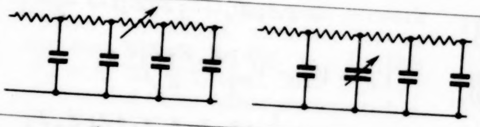
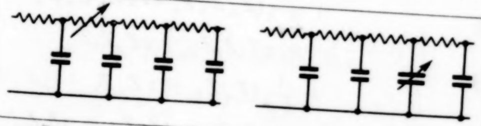
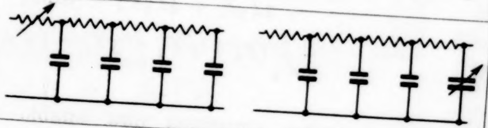
If the series arms of the three-mesh network are resistors of equal value, and the shunt arms are capacitors as in Fig. 7, then by inserting $Z_s = R$, $Z_a = 1/j\omega nC$, and $Z_b = Z_c = 1/j\omega C$ in equation (11) we obtain,

$$V_L' = V_G\{[1 - \omega^2C^2R^2(4n+1)] - j[\omega^3nC^3R^3 - \omega CR(3n+3)]\} \quad (25)$$

Phase retardation of 180° will occur when the imaginary part of equation (25) is zero; i.e., when,

$$f = \frac{1}{2\pi CR\sqrt{3 + \frac{3}{n}}} \quad \ldots \quad \ldots \quad (26)$$

TABLE I

CASE	V_L → V_G V_L → V_G	f	$\frac{V_L}{V_G}$
(a)		$\frac{1}{2\pi CR\sqrt{\frac{n+6}{6n+4}}}$	$\left\{1 + \frac{1}{n}\left[\left(\frac{6n+4}{n+6}\right)^2 - \left(\frac{6n+4}{n+6}\right)(5n+10)\right]\right\}$
(b)		$\frac{1}{2\pi CR\sqrt{\frac{2n+5}{7n+3}}}$	$\left\{1 + \frac{1}{n}\left[\left(\frac{7n+3}{2n+5}\right)^2 - \left(\frac{7n+3}{2n+5}\right)(8n+7)\right]\right\}$
(c)		$\frac{1}{2\pi CR\sqrt{\frac{2n+5}{8n+2}}}$	$\left\{1 + \frac{1}{n}\left[\left(\frac{8n+2}{2n+5}\right)^2 - \left(\frac{8n+2}{2n+5}\right)(8n+7)\right]\right\}$
(d)		$\frac{1}{2\pi CR\sqrt{\frac{2n+5}{9n+1}}}$	$\left\{1 + \frac{1}{n}\left[\left(\frac{9n+1}{2n+5}\right)^2 - \left(\frac{9n+1}{2n+5}\right)(9n+6)\right]\right\}$
(e)		$\frac{1}{2\pi CR\sqrt{\frac{n+9}{5n+2}}}$	$\left\{1 + n \left(\frac{n+9}{5n+2}\right)^2 - \left(\frac{n+9}{5n+2}\right)(6n+9)\right\}$
(f)		$\frac{1}{2\pi CR\sqrt{\frac{2n+8}{5n+2}}}$	$\left\{1 + n \left(\frac{2n+8}{5n+2}\right)^2 - \left(\frac{2n+8}{5n+2}\right)(7n+8)\right\}$
(g)		$\frac{1}{2\pi CR\sqrt{\frac{3n+7}{5n+2}}}$	$\left\{1 + n \left(\frac{3n+7}{5n+2}\right)^2 - \left(\frac{3n+7}{5n+2}\right)(7n+8)\right\}$
(h)		$\frac{1}{2\pi CR\sqrt{\frac{4n+6}{6n+1}}}$	$\left\{1 + n \left(\frac{4n+6}{6n+1}\right)^2 - \left(\frac{4n+6}{6n+1}\right)(10n+5)\right\}$

The voltage ratio in this case is, of course,

$$\frac{V_L'}{V_G} = -\left[14 + 12n + \frac{3}{n}\right] \quad \ldots \quad \ldots \quad (27)$$

By putting n equal to unity, we obtain the frequency at which the three-mesh network can give a 180° phase retardation as $f = \frac{\sqrt{6}}{2\pi CR} = \frac{0.3898}{CR}$. Under these circumstances $V_L'/V_G = -29$.

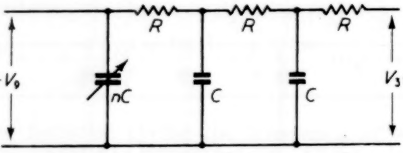


Fig. 7. *Three-mesh network with shunt-capacitance elements.*

Summaries of the results pertaining to the various forms of three- and four-mesh phase advancing and retarding networks are shown in Tables I and II.

If the variable component of the phase-shifting network is one of the series elements, then the generalized arrangement takes the form of Fig. 8. Proceeding as before, by assuming that no current is taken from the network, the relations for the voltage and current distribution are as follows,

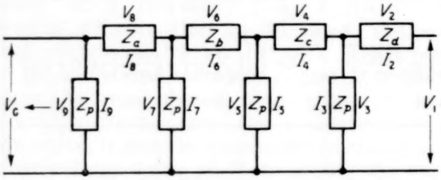


Fig. 8. *Generalized four-mesh network for series variable element.*

$$I_9 = I_8 = \frac{V_G}{Z_p} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (28)$$

$$V_8 = V_G \frac{Z_a}{Z_p} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (29)$$

$$V_7 = V_G \left[\frac{Z_a}{Z_p} + 1\right] \quad \ldots \quad \ldots \quad \ldots \quad (30)$$

$$I_7 = V_G \left[\frac{Z_a}{Z_p^2} + \frac{1}{Z_p}\right] \quad \ldots \quad \ldots \quad \ldots \quad (31)$$

$$I_6 = V_G \left[\frac{Z_a}{Z_p^2} + \frac{2}{Z_p}\right] \quad \ldots \quad \ldots \quad \ldots \quad (32)$$

$$V_6 = V_G \left[\frac{Z_a Z_b}{Z_p^2} + \frac{2 Z_b}{Z_p}\right] \quad \ldots \quad \ldots \quad (33)$$

$$V_5 = V_G \left[\frac{Z_a Z_b}{Z_p^2} + \frac{1}{Z_p}(Z_a + 2Z_b) + 1\right] \quad (34)$$

$$I_5 = V_G \left[\frac{Z_a Z_b}{Z_p^3} + \frac{1}{Z_p^2}(Z_a + 2Z_b) + \frac{1}{Z_p}\right] \quad (35)$$

$$I_4 = V_G \left[\frac{Z_a Z_b}{Z_p^3} + \frac{1}{Z_p^2}(2Z_a + 2Z_b) + \frac{3}{Z_p}\right] \quad \ldots \quad \ldots \quad \ldots \quad (36)$$

$$V_4 = V_G \left[\frac{Z_a Z_b Z_c}{Z_p^3} + \frac{1}{Z_p^2}(2 Z_a Z_c + 2 Z_b Z_c) + \frac{3 Z_c}{Z_p}\right] \quad (37)$$

$$V_3 = V_G \left[\frac{Z_a Z_b Z_c}{Z_p^3} + \frac{1}{Z_p^2}(Z_a Z_b + 2 Z_a Z_c + 2 Z_b Z_c) + \frac{1}{Z_p}(Z_a + 2 Z_b + 3 Z_c) + 1\right] \quad (38)$$

$$I_3 = V_G \left[\frac{Z_a Z_b Z_c}{Z_p^4} + \frac{1}{Z_p^3}(Z_a Z_b + 2 Z_a Z_c + 2 Z_b Z_c) + \frac{1}{Z_p^3}(Z_a + 2 Z_b + 3 Z_c) + \frac{1}{Z_p}\right] \quad (39)$$

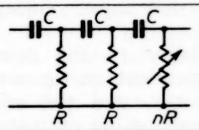
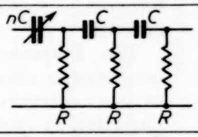
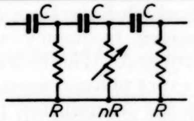
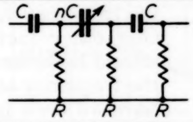
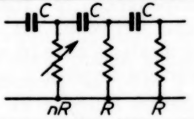
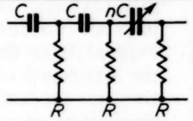
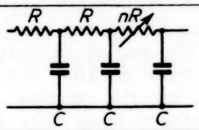
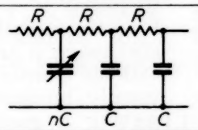
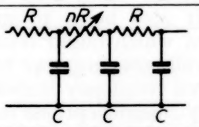
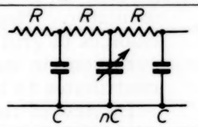
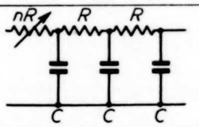
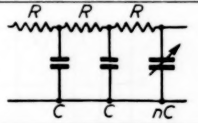
$$I_2 = V_G \left[\frac{Z_a Z_b Z_c}{Z_p^4} + \frac{1}{Z_p^3}(2 Z_a Z_b + 2 Z_a Z_c + 2 Z_b Z_c) + \frac{1}{Z_p^2}(3 Z_a + 4 Z_b + 3 Z_c) + \frac{4}{Z_p}\right] \quad (40)$$

$$V_2 = V_G \left[\frac{Z_a Z_b Z_c Z_d}{Z_p^4} + \frac{1}{Z_p^3}(2 Z_a Z_b Z_d + 2 Z_a Z_c Z_d + 2 Z_b Z_c Z_d) + \frac{1}{Z_p^2}(3 Z_a Z_d + 4 Z_b Z_d + 3 Z_c Z_d) + \frac{4 Z_d}{Z_p}\right] \quad (41)$$

$$V_L = V_1 = V_G \left[\frac{Z_a Z_b Z_c Z_d}{Z_p^4} + \frac{1}{Z_p^3}(Z_a Z_b Z_c + 2 Z_a Z_b Z_d + 2Z_a Z_c Z_d + 2Z_b Z_c Z_d) + \frac{1}{Z_p^2}(Z_a Z_b + 2 Z_a Z_c + 3 Z_a Z_d + 2Z_b Z_c + 4Z_b Z_d + 3Z_c Z_d) + \frac{1}{Z_p}(Z_a + 2 Z_b + 3 Z_c + 4 Z_d) + 1\right] \quad \ldots \quad \ldots \quad \ldots \quad (42)$$

The foregoing equations now enable us to

TABLE II

CASE	$V_L' \rightarrow$ V_G	$V_L' \rightarrow$ V_G	f	$\frac{V_L}{V_G}$
A			$\frac{1}{2\pi CR\sqrt{3n+3}}$	$-\left[14+3n+\frac{12}{n}\right]$
B			$\frac{1}{2\pi CR\sqrt{4n+2}}$	$-\left[15+8n+\frac{6}{n}\right]$
C			$\frac{1}{2\pi CR\sqrt{5n+1}}$	$-\left[16+10n+\frac{3}{n}\right]$
D			$\frac{\sqrt{\frac{5}{n}+1}}{2\pi CR}$	$-\left[16+3n+\frac{10}{n}\right]$
E			$\frac{\sqrt{\frac{4}{n}+2}}{2\pi CR}$	$-\left[15+6n+\frac{8}{n}\right]$
F			$\frac{\sqrt{\frac{3}{n}+3}}{2\pi CR}$	$-\left[14+12n+\frac{3}{n}\right]$

examine the circumstances under which any type of three- or four-mesh network can bring about phase reversal of the applied voltage.

Four-mesh Network with Series Variable

As a typical example of a four-mesh network with one series component variable, let us examine the case shown in Fig. 9. In this instance, $Z_p = R$, $Z_a = 1/j\omega nC$, and $Z_b = Z_c = Z_d = 1/j\omega C$ and if these values are inserted in equation (42), we obtain

$$V_L = V_G\left\{\left[1+\frac{1}{\omega^4 R^4 n C^4}-\frac{1}{\omega^2 R^2 C^2}\left(\frac{6}{n}+9\right)\right] + j\left[\frac{1}{\omega^3 R^3 C^3}\left(\frac{5}{n}+2\right)-\frac{1}{\omega RC}\left(\frac{1}{n}+9\right)\right]\right\} \quad \ldots \quad \ldots \quad \ldots \quad (43)$$

This form of network will therefore give a phase advance of 180° when

$$f = \frac{1}{2\pi RC}\sqrt{\frac{5+2n}{1+9n}} \quad \ldots \quad \ldots \quad (44)$$

Under these circumstances

$$\frac{V_L}{V_G} = 1+\frac{1}{n}\left[\left(\frac{9n+1}{2n+5}\right)^2-\frac{9n+1}{2n+5}(6+9n)\right] \quad \ldots \quad \ldots \quad \ldots \quad (45)$$

Three-mesh Network with Series Variable

The general solution for a three-mesh network with a variable series component, as in Fig. 10, is obtained from equation (38) as

$$V_L' = V_G\left[\frac{Z_a Z_b Z_c}{Z_p{}^3} + \frac{1}{Z_p{}^2}(Z_a Z_b + 2Z_a Z_c + 2Z_b Z_c) + \frac{1}{Z_p}(Z_a + 2Z_b + 3Z_c) + 1\right] \quad (46)$$

The formulae for the frequency at which exact phase reversal takes place with this form of network, and the voltage loss appropriate to the differing forms of the arrangement are shown in Table II.

General Conclusions

It is not easy to draw any general conclusions from the results of Tables I and II, but it is a simple matter to illustrate in graphical form the effects of altering the value of one of the variable components in any particular case. Typical examples showing the variation in frequency and the degree of amplification which must be provided to sustain self-oscillation are shown in Figs. 11 and 12. It is interesting to note that the voltage loss is not a minimum when the network has a uniform configuration, although small deviations from uniformity do not make substantial alterations in the ratio of input to output voltage. It must be obvious, however, that adjustment of any single component in the network modifies the input impedance so that there is no justification for the view that the latter remains reasonably constant if this modification has little effect on the voltage loss. The input impedance, which is in all cases complex, forms part of the anode load of the valve, so that its changes will seriously affect the stage gain unless R_L is small by comparison. Values of input impedance for any form of network may be computed from the foregoing expressions for input voltage and current.

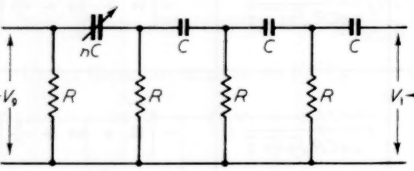


Fig. 9. *Series-capacitance four-mesh network.*

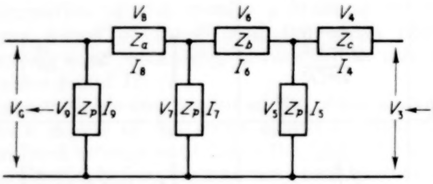


Fig. 10. *Generalized three-mesh network for variable series element.*

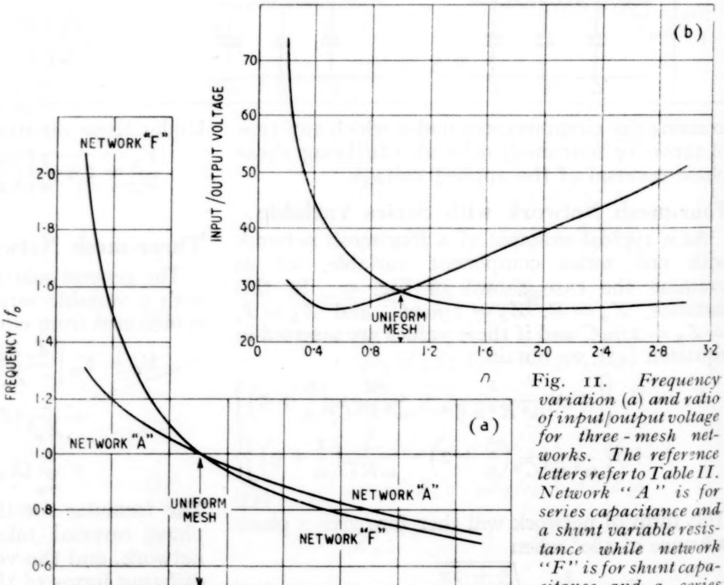


Fig. 11. *Frequency variation (a) and ratio of input/output voltage for three-mesh networks. The reference letters refer to Table II. Network "A" is for series capacitance and a shunt variable resistance while network "F" is for shunt capacitance and a series variable resistance.*

The frequency stability of the phase-shift oscillator is clearly dependent on the constancy of the component values, and the effects of variation in any of these can be estimated from the frequency formulae which have been derived. One other factor affecting frequency stability should however be mentioned. The formulae for the frequency at which exact phase reversal occurs have all been based on the assumption that the grid-cathode input impedance of the valve imposes no load on the network. It will be evident from the above analysis that in so far as the existence of grid current implies a modification in the effective shunt impedance Z_a, the frequency of oscillation may differ appreciably from the formulae given, unless the amplitude of grid swing is small. The use of an unbypassed cathode resistor to provide negative feedback is usually recommended for the purpose of preserving a good waveform from this type of oscillator. Because it also helps to minimize changes in grid current which might result from variations in supply voltages, negative feedback contributes to improved frequency stability.

In view of the many misconceptions in regard to the functioning of the phase-shifting network, it is perhaps worthwhile, in conclusion, to evaluate the voltage and current distribution for a uniform three-mesh phase advancing network such as that shown in Fig. 1 (a) The frequency at which this network provides exact phase reversal is $f = \dfrac{0.0649}{CR}$ and the voltages and currents in its different parts are given in Table III.

The input impedance of the network under these circumstances is $(0.83 - j2.7)R$. In relation to the applied voltage V_L, the voltage V_5 is advanced 55.8°, while V_7 is further advanced by 56.4°. Though these differ little from the value of 60° sometimes quoted, the latter figure often results from a totally mistaken view of the behaviour of the network.

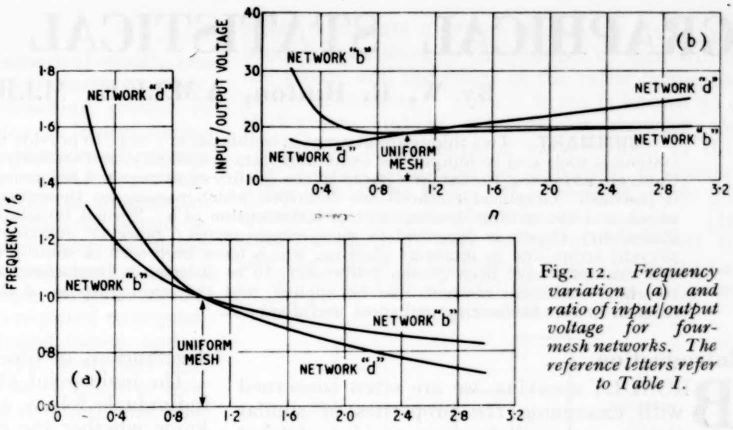


Fig. 12. *Frequency variation (a) and ratio of input/output voltage for four-mesh networks. The reference letters refer to Table I.*

TABLE III

$$V_3 = V_L'$$

$$V_4 = \frac{V_L'}{29}[24 - j3\sqrt{6}]$$

$$= 0.865\ V_L' \cos(\omega t - 17.0^\circ)$$

$$V_5 = \frac{V_L'}{29}[5 + j3\sqrt{6}]$$

$$= 0.307\ V_L' \cos(\omega t + 55.8^\circ)$$

$$V_6 = \frac{V_L'}{29}[6 + j2\sqrt{6}]$$

$$= 0.267\ V_L' \cos(\omega t + 39.2^\circ)$$

$$V_7 = \frac{V_L'}{29}[-1 + j\sqrt{6}]$$

$$= 0.091\ V_L' \cos(\omega t + 112.2^\circ)$$

$$V_8 = \frac{V_L'}{29}[j\sqrt{6}]$$

$$= 0.084\ V_L' \cos(\omega t + 90^\circ)$$

$$V_9 = -\frac{V_L'}{29}$$

$$= 0.0345\ V_L' \cos(\omega t + 180^\circ)$$

$$I_4 = \frac{V_L'}{29R}[3 + j4\sqrt{6}]$$

$$= 0.354 \frac{V_L'}{R} \cos(\omega t + 73.0^\circ)$$

$$I_5 = \frac{V_L'}{29R}[5 + j3\sqrt{6}]$$

$$= 0.307 \frac{V_L'}{R} \cos(\omega t + 55.8^\circ)$$

$$I_6 = \frac{V_L'}{29R}[-2 + j\sqrt{6}]$$

$$= 0.109 \frac{V_L'}{R} \cos(\omega t + 129.2^\circ)$$

$$I_7 = \frac{V_L'}{29R}[-1 + j\sqrt{6}]$$

$$= 0.091 \frac{V_L'}{R} \cos(\omega t + 112.2^\circ)$$

$$I_8 = I_9$$

$$= -\frac{V_L'}{29R}$$

$$= 0.0345 \frac{V_L'}{R} \cos(\omega t + 108^\circ)$$

GRAPHICAL STATISTICAL METHODS

By W. R. Hinton, A.M.I.E.E., M.I.R.E.

SUMMARY.—Two things are attempted in this paper; first, to provide the beginner with powerful statistical tools and techniques for examining data graphically, and secondly, to direct the attention of those already using Probability Paper to the quality of fit required before an assumption of normality is justified. Graphical methods are described which require no theoretical knowledge of statistics at all, and the natural development of a conception of a 'Normal Population,' and the evolution of Probability Paper, is described in most simple terms; however, sufficient information is given to prevent errors due to incorrect plotting, which have been seen in some previously published works. The examples have been chosen deliberately to be diverse, to emphasize the wide range of problems to which statistical methods can be applied, and the main purpose of the article is to encourage interest in this fascinating and most useful subject.

Introduction

BROADLY speaking, we are often concerned with examining the properties of similar things, and with forming an idea of what could be classified as a typical object. A typical object could be defined as one which is like the majority of objects in a fairly large sample. No less important is some idea of the way individuals differ from the typical one, and what proportion of the total have reasonably close properties to the typical one.

Generally these ideas are formed intuitively, and comprise the 'experience' of the observer, and quite often such ideas are difficult to define and communicate to anyone else.

Statistics is a subject which is primarily concerned with classifying, grouping and examining data, and offers a language by which the above ideas can be conveyed. For example, the most probable value of an observed quantity (i.e., the typical value) is called the 'Mode,' and a constant which is descriptive of the way in which individuals cluster round the typical value is called the 'Standard Deviation.' Likewise there are recognized graphical methods of presenting and analysing data, such as the Histogram and Ogive, which have been designed to convey particular ideas and allow certain conclusions to be drawn with a minimum of labour.

Ideas have been developed of 'populations' of individuals and of the distribution of individuals in the population; of samples of individuals from a population and of the distribution of individuals in the sample. It is not surprising to find, therefore, that an ideal parent population has been conceived; ideal, that is, in the amount of information which can be inferred from the way individuals are distributed in the population, and in the simplicity with which it can be described and defined. This ideal distribution is known as the 'Normal Distribution' or the 'Gaussian Distribution,' and is found to approximate closely to many distributions of observable quantities in nature.

The main point of testing data to see whether individuals follow a Normal Distribution, is to know whether the extensive predictions, proper to the ideal population, can be applied with any confidence to the problem in hand. This simply means that if the data is normally distributed, much labour is saved because the various predictions have been tabulated and published by theoretical workers in the field. If the data is not normal, one has to make one's own calculations and predictions.

The correct attitude is to decide what information is required from the data, and whether a graphical solution is adequate; if not, whether one has sufficient data to justify a normality test or a curve fitting analysis. Often one finds that there are so few individuals in the sample at one's disposal, that a curve fitting analysis would be rather absurd, and obviously, if this is so, any labour-saving system of curve fitting (like probability paper) is equally unreliable. For this reason probability paper is a snare for the unwary; as the temptation to use it for very small samples from unknown populations is very great. Of course, it is true that, if the data follows a normal distribution, the graph on the probability paper will be a straight line, but it may not be generally realized how little is the deviation from linearity which can be tolerated in a practical case for an assumption of normality to be justified, as will be shown later.

The novelty and fascination of probability paper tends to eclipse the usefulness of the common Ogive (from which it is derived), and an imperfect understanding of the evolution of probability paper can lead to errors due to incorrect plotting, or to a wrong interpretation of the curve. Some attempt is made, therefore, in the following notes, to provide a background of simple, graphical, statistical methods, and to demonstrate some inherent limitations of probability paper.

The Histogram

In surveying a mass of numerical results one would intuitively group identical results together, and perhaps arrange the resulting groups in ascending order of magnitude. A logical extension of this idea would be to group results which fell between definite boundaries, and to arrange these groups in ascending order of magnitude. In this way the vast amount of detail would be made more comprehensible, and any significant difference between one group and another would become apparent. For example, suppose that a Government Department was required to requisition suits for demobilized armed forces, and it was essential to conserve raw materials and labour. The problem would be to discover how many sizes of suits would be required, and how many of each should be manufactured.

The first step might be to take a sample of men at random, and measure their individual heights to the nearest inch, as shown in columns (1) and (2) in Table I. (Note, therefore, that the height of a man recorded as 58 in may actually be anywhere between $57\frac{1}{2}$ in and $58\frac{1}{2}$ in.)

TABLE I

(1) Height to the nearest Inch	(2) Number of Men	(3) Number of Men in Group	(4) % of Total Men in Group	(5) Cumulative % Men
58 ..	1			
59 ..	1	5	0.8	
60 ..	3			0.8
61 ..	7			
62 ..	13	52	8.4	
63 ..	32			9.2
64 ..	52			
65 ..	74	214	34.6	
66 ..	88			43.8
67 ..	92			
68 ..	89	256	41.3	
69 ..	75			85.1
70 ..	47			
71 ..	25	84	13.6	
72 ..	12			98.7
73 ..	5			
74 ..	2	8	1.3	
75 ..	1			100
Totals ..	619	619	100	

Suppose that the data is grouped into broader classes, for example, into men with heights between $57\frac{1}{2}$ in and $60\frac{1}{2}$ in and between $60\frac{1}{2}$ in and $63\frac{1}{2}$ in, and so on, as shown in column (3). This can be plotted as shown in Fig. 1 (a), where each pillar represents a group of data by its height, being proportional to the number of men within the group, and the edges of the pillar define the group boundaries. Such a figure is known as a Histogram, and is valuable for showing the 'Mode' or most frequent value, which in this case is about 68 in, and the dispersion, or scatter, either side of the Mode. In a word, it shows the distribution of individuals in the sample. [In some problems it may be more convenient to plot the height of Histogram pillars proportional to the percentage of total observations, as given in Table 1, column (4) and shown in Fig. 3.]

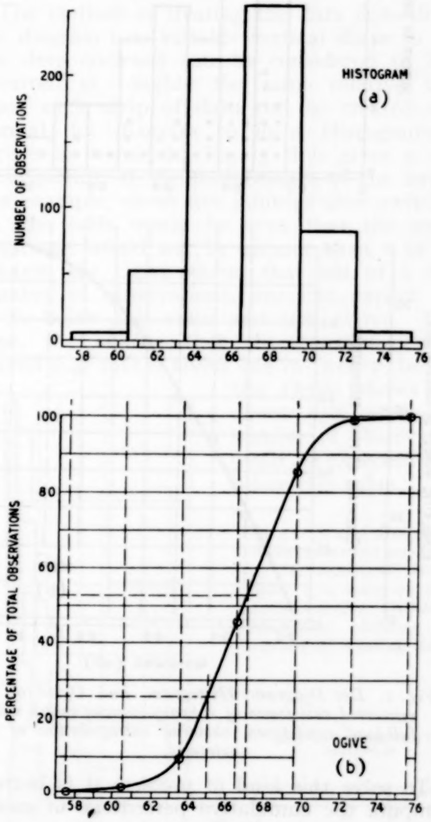


Fig. 1. *Histogram and Ogive showing the distribution of heights of 619 men, and the method of determining the proportion of men with heights between, say, 65 in and 67 in.*

The Ogive

In practice, the group boundaries of the Histogram are chosen arbitrarily so as to make a presentable figure, and whereas it is possible to see what proportion of men have heights between, say, $66\frac{1}{2}$ in and $69\frac{1}{2}$ in, it is not easy to see what proportion would have heights between 65 in and 67 in (say), or what proportion exceed 70 in in height.

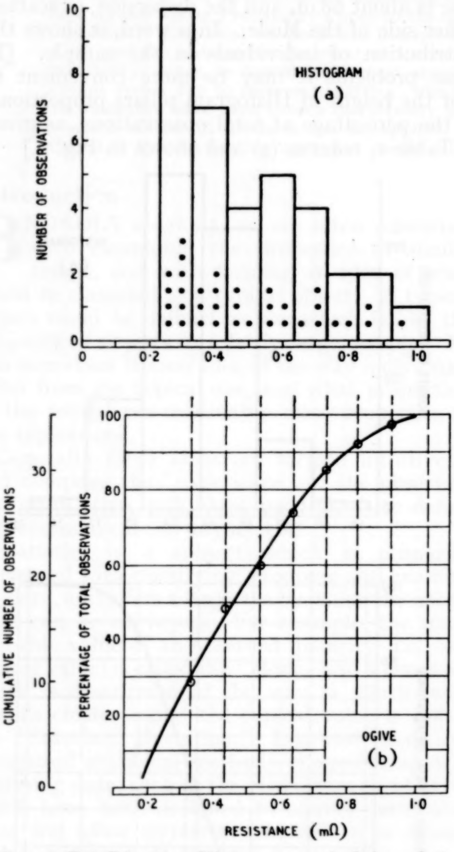


Fig. 2. *Dot Diagram, Histogram, and Ogive of the measured resistance of a heavy-current switch under full-load conditions, showing extrapolation of the extremes.*

To solve this kind of problem it is better to compute the cumulative percentage of men, as shown in Table 1, column (5). For example, 0.8% of the men had heights between $57\frac{1}{2}$ in and $60\frac{1}{2}$ in and 9.2% between $57\frac{1}{2}$ in and $63\frac{1}{2}$ in, and so on. Notice that no man is recorded with height less than $57\frac{1}{2}$ in, and that 0.8% of the men were encountered over the range $57\frac{1}{2}$ in to $60\frac{1}{2}$ in, therefore the cumulative percentages must be plotted at the edges of the class intervals, as shown in Fig. 1 (b). This curve is an "Ogive," and provides different information from the Histogram. For example, the proportion of men having heights less than 67 in is 52% and that less than 65 in is 26%, therefore the proportion of men between heights 65 in and 67 in is the difference :

$$52 - 26 = 26\%.$$

This means that if one standard design of suit is intended to fit men between 65 in and 67 in in height, the number to be requisitioned should be 26% of the total, and so on. Likewise it seems hardly worth while making suits in bulk for statures less than about 60 in or over 73 in and these men could be fitted individually.

One valuable property of the Ogive is that it is fairly insensitive to the choice of class intervals, (histogram groups) and therefore smooths out the data which was coarsened by grouping for the histogram.

This example has shown what valuable information can be obtained from the application of very elementary statistical tools and a little common sense, and there has been no need to test the data for normality, or confuse oneself with predictions based on the Normal Distribution.

The Ogive is particularly useful for analysing data whose typical value (Mode) tends to be close to an extreme value. For example, in inspecting electrical switches, the switch resistance can never be less than the resistance of the conductors forming the switch parts, but always more, depending upon the condition of the contact surfaces. In such a case the Histogram is unsymmetrical or "skew" [Fig. 2 (a)] and the Ogive shows the minimum resistance quite clearly, which is of course, a useful parameter for judging the quality of the design.

If a technique is employed so that the extreme points of zero and 100% are not plotted, the Ogive gives an extrapolated value for the minimum resistance which is insensitive to the choice of histogram class intervals, (pillar widths).

This is a reasonable technique to adopt, because otherwise the arbitrary choice of class interval would arbitrarily fix the point of zero cumulative observations at the edge of the first pillar ; whereas it is much better to let the entire data weight the choice of this point by extrapolation. Similar remarks apply to the 100% point. It is very instructive to experiment with grouping data differently, and observe how slightly the Ogive is affected.

Graphical Grouping of Data

It saves a great deal of time and labour to record each observation directly on the graph paper to be used for the Histogram, by making a bold dot opposite the appropriate point on the abscissa, thus forming rudimentary columns of dots as observations are repeated. This method has the great advantage that one can see when sufficient data has been collected, as the distribution of dots begins to suggest a definite form. It is then easy to mark the dots off into suitable groups and construct a Histogram based on the number of dots falling into each group, as shown in Fig. 2. (Where a dot falls on a group boundary, one half of an observation should count in each group.) This is called a Dot Diagram, and the intermediate step of drawing the Histogram is not necessary for constructing an Ogive, as the total number of dots encountered up to a given boundary can be seen directly. Likewise, by observing quantities to the nearest convenient unit, the dots form clean columns and have the appearance of histogram pillars, which therefore, need not be drawn.

Another advantage of collecting experimental data by dot diagrams, is that it shows up any drift in performance due to warming up of equipment, etc. This becomes apparent when one finds the columns of dots not being filled in a random manner, but that ones hand is gradually moving across the page, as time goes on. This is most noticeable in the resistance measurements mentioned earlier, and the solution is to make several independent experiments, noting the time from the instant of switching on at which the observation is made. (Obviously the switch must be given time to cool down between experiments and strictly speaking, the observations should be made at about the same rate.) The data is recorded as bold dots, or other marks, located at the appropriate time, as shown in Fig. 3, and constitutes a Scatter Diagram which is intended to show whether one variable seems to depend on another. Clearly, in Fig. 3, the value of switch resistance observed, depended, to a great extent on the relative time at which the observation was made.

The method of treating the data is to divide the diagram into suitable vertical strips so that the dots enclosed can be considered to have occurred at roughly the same relative time. Then each strip of data can be treated as a normal dot diagram to form Histograms or Ogives as required. Fig. 3 thus gives a very clear picture of the performance of the switch. For example, about five minutes after switching on, the odds would be even that the switch resistance would not be greater than 0.32 mΩ because the Ogive shows that out of a large number of observations, one can expect 50% to lie below this value and 50% above. Likewise, the chance that the resistance would exceed 0.47 mΩ is about one in twenty, because the Ogive shows that about 95% of a large number of observations could be expected to be below this value.

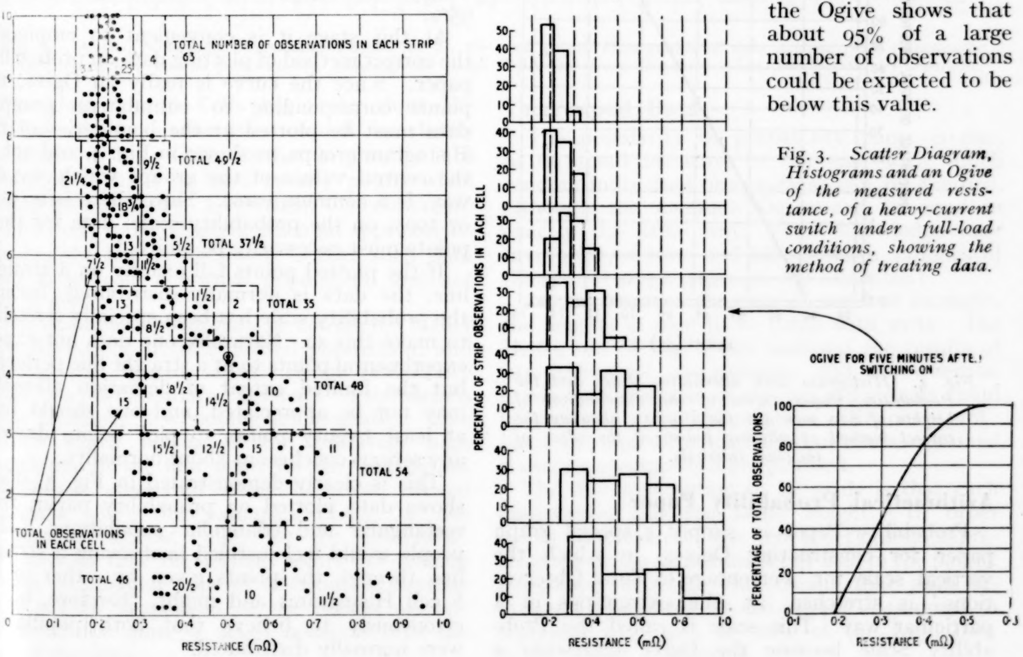


Fig. 3. *Scatter Diagram, Histograms and an Ogive of the measured resistance, of a heavy-current switch under full-load conditions, showing the method of treating data.*

Before leaving the subject of Dot and Scatter Diagrams, there is one disadvantage that should be mentioned, namely that because one can see the diagram taking shape, one is inclined to cheat, or shall we say, be biased in one's judgment, and cast the dots into where one thinks they should go. A great deal of self-discipline has to be exercised.

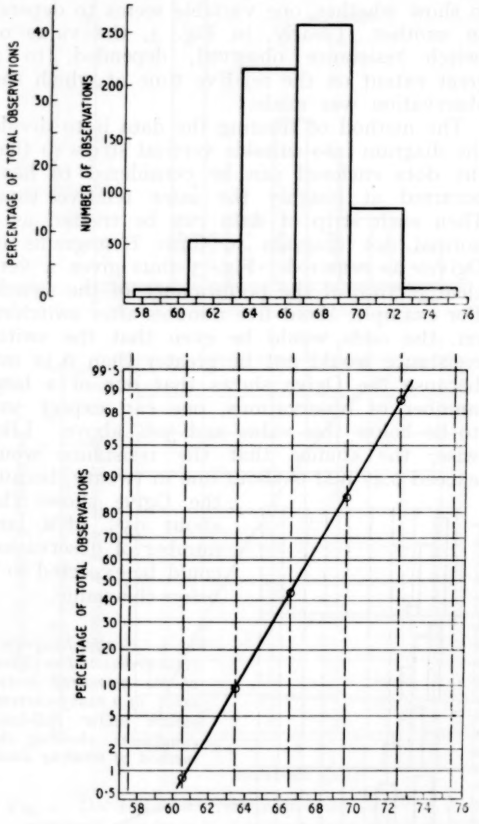


Fig. 4. Histogram with alternative scales and the Probability Paper Ogive of the distribution of heights of 619 men (as for Fig. 1), showing the correct method of plotting points at the edges of the class intervals.

Arithmetical Probability Paper

Probability Paper is simply a special graph paper for constructing Ogives, in which the vertical scale for 'Percentage of Total Observations' is stretched, at the extremities in a particular way. This scale is called the Probability Scale because the Ogive represents a population of a large number of individuals from which one can deduce the odds of an observation falling above or below a particular value. Let it be emphasized at once that it is not essential to use special probability paper to do this; indeed we have seen in the previous section that the common Ogive can be used.

The prefix, 'Arithmetical' means that the scale for the variable is linear, while with Logarithmic Probability Paper, the scale for the variable is logarithmic; the probability scale being the same as for the arithmetical paper. Obviously, one could use a logarithmic scale for the variable, in the construction of the common Ogive, if such a scale offered a clearer picture of the data.

Most Ogives are S-shaped curves, and become difficult to read at the extremes. If the scale is expanded over these sections, the readability of the graph is increased, but this does not mean that the reliability of the data is increased. In exactly the same way, inspecting the position of an ammeter pointer with a powerful magnifying lens does not increase the precision of a current measurement, because the calibration may not be reliable. This means that when Ogives are plotted on probability paper, one must be extremely cautious about making use of extrapolated information at the extremes of probability scales, say, outside the range of 5% to 95%.

At this stage it is convenient to emphasize the correct method of plotting data on probability paper. Since the curve is really an Ogive, the points corresponding to cumulative grouped data must be plotted at the boundaries of the Histogram groups, as shown in Fig. 4, and not at the central values of the groups which, by the way, is a common error. Since there is no zero or 100% on the probability scale, data for these points must necessarily be omitted.

If the plotted points fall exactly on a straight line, the data is normally distributed, because the probability scale has been specially stretched to make this so. Naturally one does not expect experimental points to fit a straight line perfectly, but the limited extent of deviation allowable may not be appreciated, and one should have at least twenty points to plot before drawing any serious conclusions about normality.

This is clearly demonstrated in Fig. 5, which shows data plotted on probability paper, from rectangular and triangular populations. Most people would feel justified in drawing a straight line through the points given by either of the 8 cell Histograms and might, therefore, be led erroneously to believe that both populations were normally distributed.

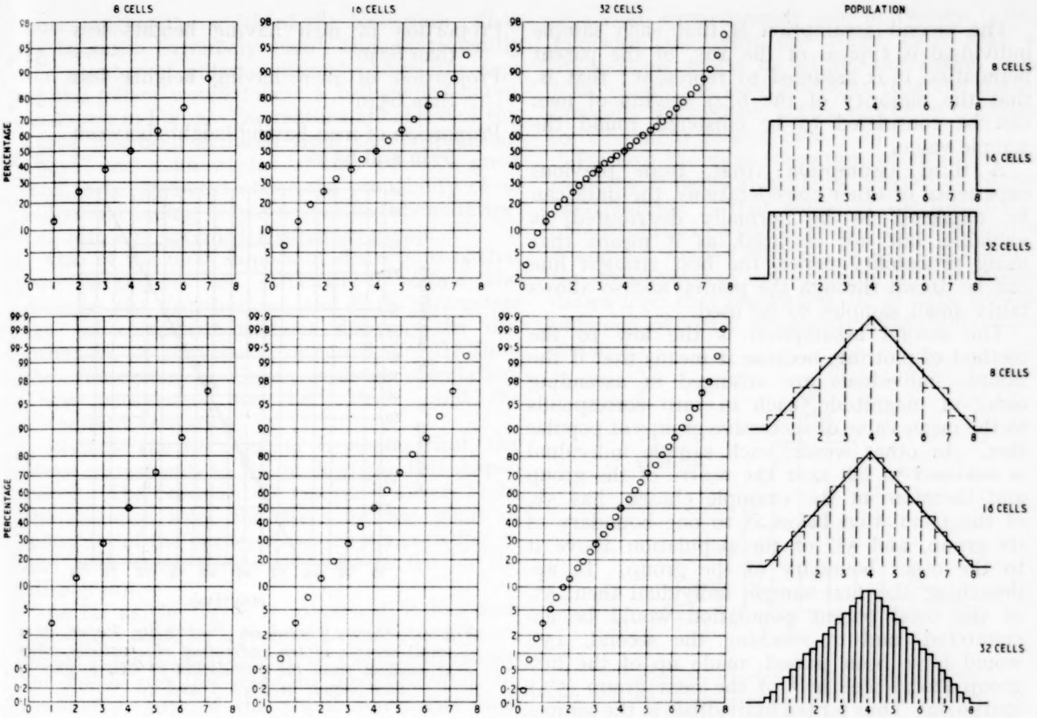


Fig. 5. *Ogives, plotted on Probability Paper, for 8-, 16- and 32-cell Histograms of data arising from rectangular and triangular parent populations, showing the small departure from linearity when few points are available.*

The data for 16 Cells begins to show the curving of the extremities, which is clearly confirmed with 32 Cells, so that in practice it is advisable to have at least twenty points when testing for normality. Even then, the recommended attitude to be adopted, when an approximately straight line is obtained, is that such data *could* arise from a normal population, and not that it *does*.

The examples shown may be considered rather wide deviations from a normal population, and indicate the limited sensitivity of probability paper to differentiate between distributions when relatively few points are available. One feature worth noting is the relatively high probability of the first point for the rectangular distribution compared with the more normal triangular one ; for example, 12.5% for the rectangular, against 3.1% for the triangular. This reveals that the former points are coming from a rectangular type of distribution because quite a high proportion of the results are encountered for quite a small invasion into the edge of the data.

Ungrouped Data

The popularity of probability paper is due, in no small measure, to the ease with which random individual observations can be handled, although the common Ogive can be used in exactly the same way. (This knowledge may save a lot of time and labour when supplies of the special graph paper are not available.)

Let us consider the case of our first example, the heights of men to be fitted with suits. The Histogram of Fig. 1 has analysed the results of 619 individual observations, and the question is whether a sample of say ten individuals could provide the same information. Obviously not : but a fair idea of the distribution can be obtained if certain assumptions are justified.

The first assumption to be made is that each observation has the same weight. In other words that each of the ten observations represents about the same number of men in the parent population of 619. This means that each individual observation in the sample is assumed to represent 61.9 men or 10% of the total men in the parent population.

The second assumption is that each sample individual is typical of the 10% of the parent population it is assumed to represent; that is, that the majority of the 61.9 heights of men can be considered to be clustered round the sample value.

A third assumption (that, from previous experience or other considerations, the data can be expected to be normally distributed) is valuable, but not essential, as it means that using probability paper, the best straight line can be drawn through the points, and so allows fairly small samples to be used.

The second assumption is the key to the method of plotting, because it means that if the sample individuals are arranged in ascending order of magnitude, each in turn corresponds to the mean value of successive groups of population. In other words, each sample individual is assumed to fall near the centre of the group and therefore in the example chosen, has 5% of the population below it to one boundary of its group, and 5% of the population above it to the other boundary of the group. In approaching the first sample individual then, 5% of the total parent population would be encountered, and in reaching the second, 15% would have been passed, made up of the first group (10%) plus half of the next group (5%), and so on. Thus for ten individuals in the sample, they should be plotted on the Ogive, or on probability paper, at the following percentages of total observations:

5, 15, 25, 35, 45, 55, 65, 75, 85, 95%.

In general, if there are n observations in a sample, they should be spaced at $100/n$% and the first observation should occur at $100/2n$%. Example: Suppose the heights of ten men, taken at random, were as shown in Table II, and that it was known that a normal distribution could be expected. The proportion of men with heights between 65 in and 67 in is required.

TABLE II

	Inches									
Heights of ten men taken at random, and placed in ascending order	63	64	65	66	66	67	68	69	70	71
Plot on Probability Scale at the following percentages	5	15	25	35	45	55	65	75	85	95

The results are shown plotted on probability paper in Fig. 6, and from the best straight line, we have:

Proportion of men having heights less than 67 in = 52%

Proportion of men having heights less than 65 in = 25%

Proportion of men having heights between 67 in and 65 in = 27%

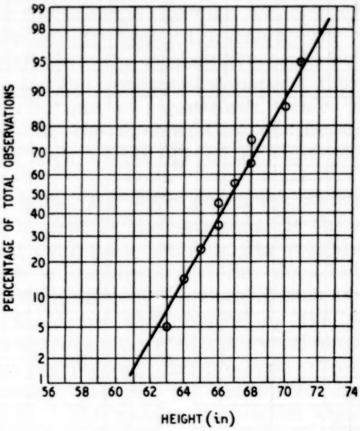


Fig. 6. *Ogive, plotted on Probability Paper, of a small sample of ten individual observations taken at random from the population of 619 heights of men shown in Figs. 1 and 4.*

The Normal Distribution

So much has been said about testing for normality, and whether or not individuals can be expected to follow a normal distribution, that a short discussion of its properties is appropriate at this stage.

As mentioned previously, the Normal Distribution is a conception of an ideal population of individuals, from the point of view of mathematical analysis. It is based on the assumption that deviations of individuals, from the mean value, obey three laws:

(1) The probability of small deviations from the mean value is greater than the probability of large deviations.

(2) The probability of a certain deviation above the mean value is equal to the probability of an equal deviation below the mean value.

(3) The probability of a "huge" deviation is very small indeed.

If we imagine a 'Normal' Histogram, the first law means that the central pillars tend to peak near the mean; the second law means that the histogram is symmetrical about the mean; and the third, that the columns vanish fairly quickly as the distance from the mean increases. If we now imagine the width of the histogram pillars to be made extremely small, and consequently the number of pillars extremely large, the tops of the pillars would follow a bell-shaped curve, as shown in Fig. 7. The mathematical law of this curve has been deduced from the postulations above, and a knowledge of this allows a great deal to be predicted about the probability of an individual falling between specified boundaries; i.e., into any specified Histogram group.

One of the most important deductions is that two parameters are sufficient to define and describe the distribution; and both parameters can be calculated without drawing the distribution, or conversely, obtained directly from the Histogram or Ogive, without calculation. These parameters are the 'Mean' and the 'Standard Deviation.'

Because the distribution is symmetrical, the Mean corresponds to the peak of the bell-shaped curve. The Standard Deviation is taken to be the distance from the Mean to the point of inflection of the curve, shown as sigma in Fig. 7, and both these points are easy to see on the Histogram.

As far as the Ogive is concerned, it has been calculated that, for a Normal Distribution, 34.2% of the total population can be expected between the mean and the standard deviation and, by symmetry, 50% of the population exists each side of the mean. This means that the standard deviation can be found by taking the difference in abscissa corresponding to ordinates of 50% and 15.8% (34.2% from the mean), or ordinates 50% and 84.2% as shown in Fig. 7.

The Standard Deviation is used as a yardstick for specifying the distribution of individuals in a normal population, and tables are published giving the proportions of population encountered between the mean and various deviations expressed as fractions or multiples of a standard deviation. Table III is a simplified version of one.

TABLE III

Deviation from Mean	Percentage of Total Population :		
	Between Mean and Deviation (%)	Between ± Deviation (%)	Outside range of ± Deviation (%)
$\frac{2}{3}\sigma$ (approx.) ..	25	50	50
σ	34·2	68.3	31.7
2σ	47·7	95·4	4·6
3σ	49·85	99·7	0.3

For example, one can see that the chance of an individual observation falling outside the range $\pm 2\sigma$, is approximately one in twenty (4.6%). Likewise, the odds are about even that an observation would be within the range $\pm \frac{2}{3}\sigma$. (One should be very confident that the data is normally distributed, before venturing to predict for deviations greater than 3σ.)

Perhaps the most important of all deductions made by theoretical workers, concerning Normal Distributions, is that whatever the distribution of individuals in a parent population (rectangular, triangular, double humped, or any other shape), the distribution of the means of random samples drawn from that population, tends to be Normal, provided, of course, the parent population remains stable.

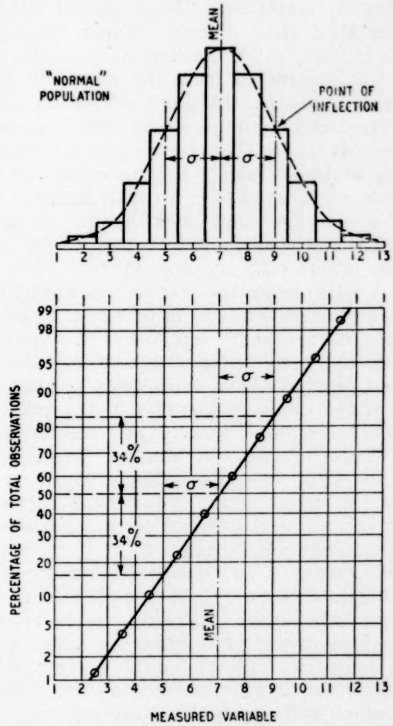


Fig. 7. *Histogram, and Probability Paper Ogive, of a 'Normal Distribution,' showing the method of recognizing the parameters 'Mean' and 'Standard Deviation'.*

This last comment is the key to one important application of Probability Paper, namely to test the stability of populations. Successive batches of twenty or more means of samples, should show roughly the same mean and standard deviation if the population is stable. This is the basis of Quality Control, where instability in the parent population of objects means that rejects will occur unless the drift is arrested. When a sample is obtained with a mean value deviating from the grand mean by a certain amount, one is justified in using Normal Distribution Tables to compute the probability that such a deviation could be expected by pure chance, and act accordingly. Notice, however, that it is not absolutely essential to understand Normal Distributions to operate a Quality Control system; one could conduct a 100% inspection at the beginning of production, when the process was operating satisfactorily, and construct an Ogive from the results. This could then be used to define the limits within which subsequent sample individuals should fall.

Remember that if one intends to use the means of samples of five individuals, the Ogive must be constructed from the means of groups of five individuals. In short, decide on the size of sample, and commence with 100% inspection. This simply means that the samples are successive groups of individuals. Calculate the mean of each sample and plot as a dot diagram. When the dot diagram takes on a definite shape, plot the Ogive. Decide now how many false alarms can be tolerated, say one in ten, and select limit values from the Ogive accordingly. In the example chosen, one is prepared to be given a false alarm once in ten times, in other words 10% of the total population will be allowed to fall outside the Ogive limit lines so that about once in ten times an observed mean will exceed the limits by pure chance. This means that the limits must be chosen to allow 5% of the population to occur below the lower limit, and 5% above the upper limit. Thus draw lines on the Ogive at 5% and 95% and read off the corresponding limits of the variable.

Take samples at reasonable intervals, and investigate as soon as any sample mean exceeds either of the limits. (If the sample means are plotted as a scatter diagram in time, and the limit lines are marked on the scatter diagram, it is easy to see when there is a drift in the process which will eventually cause rejects.)

This elementary system of Quality Control is the basis of the more refined methods, which are designed to economize in labour by taking advantage of other theoretical deductions and properties associated with Normal Distributions.

Conclusions

The author hopes that the reader will agree that the first conclusion is that a great deal of useful work can be done graphically, with Histograms, Ogives and Scatter Diagrams, without any theoretical knowledge of Normal Distributions, and the like. This is important because it encourages the use of efficient statistical methods among those who might be put off by a more theoretical approach, and provides a good background for the appreciation of the more advanced ideas, later on. The danger of a limited theoretical knowledge lies in the temptation to use apparently simple tools, which have been developed from very advanced theory, because then they are imperfectly understood, and erroneous conclusions may be drawn from the results.

Probability Paper is directly concerned with Normal Distributions and this implies that some knowledge of the theory of these distributions is desirable for its correct use. Generally the use of it will be justified only when some application of the properties of normal distributions is sought, for example, when used as a labour-saving device to avoid calculations, and economize in size of sample, when the data is known to be normally distributed. Or again, when testing the stability of populations, making use of the expected normal distribution of sample means.

The actual testing of data for normality should be regarded cautiously, and not seriously attempted with less than twenty points, preferably more. One should also have a clear idea whether a test for normality is justified. For example, in the problem of providing suits for men of various heights, it is absolute nonsense to make elaborate tests and extensive predictions concerning the normality of the heights, in order to avoid waste of materials, when the selection is ultimately influenced by personal preferences in colours, designs and cuts. An Ogive analysis would be adequate to get the proportions approximately right.

Likewise, as the author knows to his cost, it is advisable to check the data for stability of parent population before attempting any serious curve fitting.

The final conclusion drawn, is that Probability Paper is rather an insensitive tool for discriminating between distributions, and a large number of points are required before pronouncing judgment on the probable Parent population.

Acknowledgments

The author wishes to express his thanks to the Chief Scientist of the Ministry of Supply for permission to publish this article, and to those friends and colleagues who first introduced the writer to this most fascinating and useful subject.

CORRESPONDENCE

Letters to the Editor on technical subjects are always welcome. In publishing such communications the Editors do not necessarily endorse any technical or general statements which they may contain.

Network Theorem

SIR,—Some 15 or 20 years ago, I noticed that the theorem stated here could be derived very simply from the basic equations which define the properties of a quadripole.

The derivation appeared to be so obvious that I presumed it to be well known. Experience over a long period has shown, however, that this is not the case and I feel that it should be published. It will doubtless draw the fire of experts in the field, but it may prove useful to the larger group who employ network theorems to shorten the labour of circuit analysis and design.

The theorem may be stated as follows :—

"In any linear, passive network in which the application of a p.d. E_A to a pair of terminals 'A' leads to the appearance of a p.d. E_B at another pair of terminals 'B,' the injection of current i_B at 'B' will lead to the appearance of a current i_A in a link strapping terminals 'A,' the ratio i_B/i_A being equal to the ratio E_A/E_B."

Put broadly this indicates that the ratio between the output open-circuit p.d. and the input p.d. is identically equal to the ratio of the output short-circuit current to the input current, the direction of transmission of power through the network being reversed in the second case.

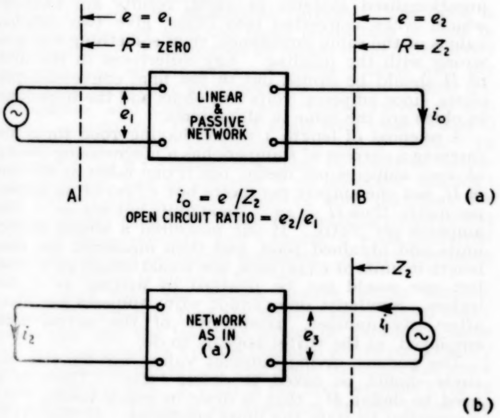


Fig. 1

The proof is simple. Referring to Fig. 1 it should be observed that Z_2, the output impedance in (a) is identical with the input impedance in (b) because terminals A are in both cases short-circuited, the generator in (a) being of zero internal impedance. By reciprocity $i_0/e_1 = i_2/e_3$, but $i_0 = e_2/Z_2$ and $e_3 = i_1 Z_2$; therefore, $e_2/(e_1 Z_2) = i_2/(i_1 Z_2)$, whence $e_2/e_1 = i_2/i_1$.

This theorem is of more than academic interest, for it has been applied directly to the design of new networks from known types. Moreover, it has practical applications. An example will illustrate this :—

Let us suppose it is required to measure, experimentally, the ratio between the input current to one branch of a network and the output current flowing in a second branch of the network. Let us suppose also that, as is often the case, it is impossible to place a current meter (or a resistance across which a p.d. could be measured) in the second branch ; then the theorem can be applied and the desired ratio derived by voltage measurements, power being applied at a break in the second branch and the output p.d. being measured across the first branch.

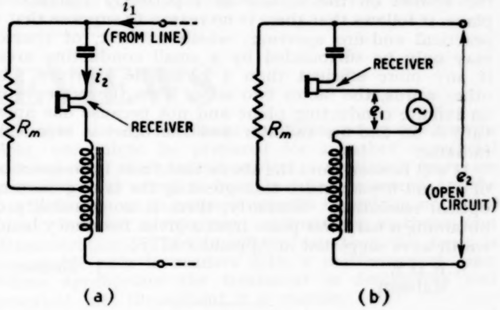


Fig. 2

An example of the experimental application is given in Fig. 2. Here the network on test is the Post Office Standard C.B. Telephone Instrument circuit. It is required to know the current i_2 in the receiver per unit of input line-current, i_1. To measure this by the p.d. across the receiver involves the measurement of the receiver impedance, and correction for changes in this as the frequency of i_1 is altered.

By the arrangement of (b) the voltage ratio e_2/e_1 is measured directly and this, by the theorem, is identical with the ratio i_2/i_1.

Southbourne,
Hants.

E. R. Wigan.

Gain of Aerial Systems

SIR,—In the September 1949, issue of *Wireless Engineer*, Mr. D. A. Bell states that "the maximum gain of an aerial in which the effective phase varies gradually, by a total amount of approximately π from one edge of the aperture to the opposite one, is twice the gain of a uniformly illuminated aperture." The implication that an aperture of given size is twice as efficient when operating as an end-fire radiator as when operating as a broadside radiator, is of practical importance particularly since, with the development of radio lenses, it is becoming more easy to control both phase and amplitude across an aperture. Unfortunately, as will be shown below, this increase in gain is not realizable in practice and is no more than the normal increase in gain when a radiator is placed at the surface of a perfect reflector.

In calculating the polar diagram of an aperture by the usual Fourier Transform method, it is assumed that the field strength is zero everywhere in the plane of the aperture except actually within the aperture boundary ;

i.e., that the aperture is set in an infinite perfectly conducting plane. When the aperture is uniformly phased, the radiated field will be negligible in the vicinity of the aperture plane, outside the aperture, and it will make little difference to the final result whether the aperture lies in a conducting plane or not. The theoretical result, which assumes a conducting plane may, therefore, be applied to the practical case, when no such plane exists.

When, however, the aperture is so energized that an end-fire beam is radiated, the field strength in the vicinity of the conducting plane is no longer zero, at any rate in the direction of the beam. It is, therefore, not possible to realize the theoretical result from the Fourier transform unless the radiating aperture is assumed to be situated at the surface of a perfectly conducting plane. Since the gain of any aerial system is doubled by placing the system on the surface of a perfectly conducting plane, it follows that there is no reason to suppose that a practical end-fire aperture, which at best, of course, may only be surrounded by a small conducting area, is any more efficient than a broadside aperture. In other words, the factor two arises from the presence of an infinite conducting plane and not because one aperture is an end-fire radiator and the other a broadside radiator.

It will be seen from the above that there is no question of an end-fire aperture transgressing the laws governing optical resolution. Similarly, there is no possibility of obtaining a narrower pulse from a given frequency bandwidth as is suggested in Appendix II (ii).

R.R.D.E.,
Malvern.

J. Brown.

The Intrinsic Impedance of Space

Sir,—The paradox dealt with in your September Editorial raises an important issue concerning 'rationalization' of a system of units.

As is well known, the relation $\int_0 H ds = 4\pi i$ which is valid for an unrationalized system, is replaced by $\int_0 H ds = i$ in a rationalized system. One example of the result of this is that we have the following two expressions for the magnetic-field intensity in a long solenoid

Rationalized	*Unrationalized*
$H = \frac{ni}{l}$	$H = \frac{4\pi n i}{l}$

For a given physical system (i.e., for given numerical values of n, i and l) we shall thus have two different values for H, according to whether we are using a rationalized or an unrationalized system. Only two explanations of this are possible: first, that what we have called H in a rationalized system is really a different concept from what we have called H in an unrationalized system; or, secondly, that H is the same concept but is expressed in different units in the two systems. The latter explanation is widely accepted, but is it correct?

The laws of physics (e.g., Ohm's Law) were expressed by their discoverers as proportionalities. The units of the quantities involved were then so chosen as to make the constant of proportionality equal to unity or (less often) some other simple number. The algebraic equations thus define and inter-relate the units. Even without reference to any physical system we may legitimately write 1 volt equal to 1 amp times 1 ohm (or, volt = amp × ohm). This justifies the valuable procedure of substituting both figures *and units* into formulae and carrying out the operations of multiplication and division not only with the figures (to determine the numeric part of the result) but also with the units (to determine the units in which the result is expressed).

Now consider a solenoid of length one metre, having 1000 turns and carrying a current of 1 A. With the unrationalized system we have H equal to $4\pi \times 1000$ A/metre while with the rationalized system we have H equal to 1000 A/metre. The units in the two cases are the same as determined by the unit-substitution method. We, therefore, conclude (with distressingly small support from our friends) that the concept of magnetic-field intensity in a rationalized system is different from the concept which goes by the same name in an unrationalized system, though both are expressed in the same units. It is as though two persons were speaking of the 'size' of a circle, one of them meaning the radius and the other the circumference.

In both a rationalized and an unrationalized system the intrinsic impedance of a medium may be defined as the ratio of electric-field intensity to magnetic-field intensity in plane waves travelling through the medium. Electric-field intensity is the same concept in both systems, but magnetic-field intensity is not. Thus the concept of intrinsic impedance in a rationalized system differs from the concept which goes by the same name in an unrationalized system, and it is not in the least surprising that, for free space, one of these concepts is represented by 377 ohms whereas the other is represented by 30 ohms.

Emrys Williams.

University College of North Wales,
Bangor.

[There is one very satisfactory statement in the above letter, and that is that the writer gets small support from his friends; it would be distressing were it otherwise.

If, after calculating any impedance by juggling with electric- and magnetic-field intensities in rationalized and unrationalized systems of units, results are obtained which, when converted into ohms, give two different values of the same impedance, then something has gone wrong with the juggling. Any differences in the units of H should be ironed out in the final conversion into ohms, since amperes, volts and ohms and the impedance in ohms are the same in all systems.

A solenoid of length 1 metre, having 1000 turns and carrying a current of 1 ampere has a magnetizing force H of 1000 amperes per metre, but if one takes as the unit of H, not one ampere per metre but $1/(4\pi)$ of an ampere per metre, then $H = 4\pi \times 1000$ units but not $4\pi \times 1000$ amperes per metre. If one measured a length in inch units and obtained 1000, and then measured the same length in units of $1/(4\pi)$ inch, one would obtain $4\pi \times 1000$, but one would not be justified in writing $4\pi \times 1000$ inches. Similarly, one cannot write amperes per metre after any number, irrespective of the actual units employed, as the writer appears to do.

The persons giving different values for the size of a circle should be asked to define 'size.' There is no need to define H; that is done in many books, but it is essential to state the units employed. G. W.O. H.]

Secondary Emission Tubes in Wideband Amplifiers

Sir,—Secondary emission tubes such as the Philips EFP60 have obvious application in amplifiers for a wide band of frequencies by virtue of their high mutual conductance and low output capacitance. It seems, however, worth while to draw attention to a further facility, which is not generally realized, although it has been known for many years. This is the possibility of obtaining a push-pull output from a single tube, by having loads in series with both dynode and anode. Since the anode current exceeds the (negative) dynode current by a factor of 1.3, with mutual conductances in the same ratio, if exactly equal and opposite outputs are required then the respective loads must be in the inverse ratio.

A number of such tubes may be used to provide push-pull output from a distributed amplifier.[1] The control grids would be fed from one delay line in the normal manner, while one series of inductances between the anodes and another series between the dynodes would form the two output lines. For exact push-pull the characteristic impedances of the two lines must be in the inverse ratio of the corresponding mutual conductances, and further their velocities of propagation must both be equal to that of the grid line. To satisfy both these requirements the ratio of anode to dynode capacitance must be the same as the mutual conductance ratio; in the case of the EFP60, this will involve the addition of external capacitance to the dynode.

Data are not yet available for the grid input conductance of the EFP60, but from structural considerations it is probably the same as the EF50, namely 1000 μmhos at 100 Mc/s, as compared with 130 μmhos for the 6AK5 at the same frequency. However this higher input conductance will not be a serious disadvantage except at frequencies above 100 Mc·s, particularly since the larger current change available will permit fewer tubes to be used for a given output.

Preliminary results indicate that to obtain a push-pull output of 160 volts excursion with bandwidth of 50 kc/s to 100 Mc/s, 14 6AK5 tubes with a total voltage gain of 30 could be replaced by four EFP60 with a voltage gain of 65. This is for use as a pulse amplifier with low steady current in the EFP60 in order to keep within wattage limitations.

N. F. Moody,
Chalk River Laboratory, G. J. R. McLusky.
National Research Council of Canada.

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[1] Ginzton, et al., *Proc. Inst. Radio Engrs*, August 1948, Vol. 36, No. 8.

BOOK REVIEWS

Industrial High Frequency Electric Power

By E. May, B.Sc., M.I.E.E. Pp. 355 + xi with 208 illustrations. Chapman & Hall, 37 Essex St., London, W.C.2. Price 32s.

This book, which is intended to serve as an introduction to the field of industrial high-frequency technology, is based on a course of lectures given at Birmingham Central Technical College by the Author, who is the chief electrical engineer to Birlec Ltd. It starts at the beginning and Chapter 1 is a summary of basic circuit theory, with special reference to alternating currents. The book is largely concerned with the rapid production of heat in the place where it is required by means of high-frequency magnetic and electric fields. Chapter 2 deals with arc and spark oscillators and inverters, Chapter 3 with h.f. alternators, and Chapter 4 with triode valves as h.f. power generators. Chapter 5 deals with class B and C operation of power amplifiers with tuned loads. In Chapter 6 the h.f. current is applied to magnetic induction heating, and in Chapter 7 to dielectric heating; the latter includes such things as stub matching for tuning feeds. Chapter 8 deals with auxiliary equipment and h.f. measurements, and Chapter 9 with industrial applications and operating problems. A very extensive list of references is given at the end

We note that the author always writes ampère, apparently unaware that the accent was dropped many years ago, like the last two letters of Faraday's name and the last letter of Volta's. He also writes consistently KC/S, although the person who made the diagrams knew better and has kc/s. KVAR in the text becomes kVar in the diagram. There is an American flavour about the chapter on valves with its plate currents and plate voltages, but these are minor details. The description is always very clear, the diagrams are excellent, and the book can be unreservedly recommended to anyone interested in this subject of growing importance.

G. W. O. H.

Permanent Magnets

By F. G. Spreadbury, A.M.Inst.B.E. Pp. 280 + viii. Sir Isaac Pitman & Sons, Ltd., Parker Street, London, W.C.2. Price 35s.

During recent years technical and commercial developments of permanent magnets have gone ahead so rapidly as to outstrip the literature of the subject, so such an up-to-date and comprehensive work as this is particularly welcome. The author's output having been so considerable and by no means concentrated in one narrow field, one might be prepared for a rather superficial treatment of the present subject. Any such fears are proved by the event to be unjustified, however, and he has gone almost to extreme lengths in leaving no statement, however elementary, without its mathematical demonstration. That is not to say that the book is acceptable only to readers with a mathematical bias; where appropriate the treatment is descriptive and practical, and throughout it is concise.

Chapter 1 is a review of the fundamental principles of magnetism with special attention to those used in the calculation of permanent-magnet circuits. It is perhaps a pity that the author did not take this opportunity to change over to the internationally-adopted m.k.s. system of units. One or two non-standard symbols were noted in this chapter (σ for resistivity and ρ for reluctance), and the use of dl (not even δl) to denote the length of the gap cannot be commended. Data on permanent-magnet materials are given in Chapter 2, including such recent developments as bakelite-moulded magnets. A concise account of the theories of magnetism, past and present, follows in Chapter 3. An important aspect of permanent-magnet circuit design—magnetic leakage—has Chapter 4 to itself. Then follow: Chapter 5 on applications of permanent magnets; Chapter 6 on magnetic design; Chapter 7 on magnetic measurements and instruments; Chapter 8 on magnetization and magnetizers; and Chapter 9 on demagnetization and demagnetizers. The last two include some examples of the author's own design.

In Chapter 5, special interest will no doubt be taken in the section devoted to loudspeakers. The theoretical treatment of the factors involved hardly hints at the complexity wrapped up in the mechanico-acoustical properties of the cone, however.

The book is not only well written but excellently produced, and few misprints were noticed. M. G. S.

Einführung in die Theorie der Spulen und Übertrager mit Eisenblechkernen

By Richard Feldtkeller. S. Hirzel Verlag, Stuttgart. In 3 parts: Part I Spulen. Pp. 190 with 120 illustrations. 10.50 Marks. Part II Übertrager. Pp. 130, with 83 illustrations. 8 Marks. Part III Berechnungsunterlagen. Pp. 65, with 70 illustrations. 4 Marks.

This "Introduction to the Theory of Coils and Transformers with laminated-iron cores" is one of a series of monographs dealing with telegraphy and telephony. This is a second edition, revised and extended; the first edition was published in 1944. It deals with the subject from the point of view of the telecommunication engineer and, although it is very mathematical in parts, it is at the same time very practical, and the problems of design are always kept in view. The first volume deals with coils, the second with transformers, and the third consists of graphs and tables to be used in detailed calculation and design.

The author is a professor at Stuttgart Hochschule and Director of the Institute for 'Nachrichten Technik.'

An iron-cored coil is simple enough if one assumes a constant permeability and neglects hysteresis and eddy currents, but the problem becomes very complex when these things are taken into account. Hysteresis necessitates the introduction of complex permeability, and this is further complicated by the effect of eddy currents in the iron laminations on the flux distribution. Further problems are introduced if the alternating current is superposed on a direct current, and if air-gaps are present. All these points are discussed very fully.

In the second volume these complexities are put aside and the coupling transformer is dealt with on more orthodox lines. Load matching, effect of magnetic leakage, effect of self-capacitance of coils, resonance conditions, width of frequency band and such matters are all discussed and the results set out mathematically and graphically.

The book incorporates a large amount of experimental data obtained by measurements on various types of laminations, and this is used in the design data.

This book is undoubtedly a valuable addition to the available information on this subject.

G. W. O. H.

Tables of Higher Functions

By Jahnke and Emde. Fourth Revised Edition. Pp. 300 + xii, with 177 illustrations. B. G. Teubner Verlagsgesellschaft, Leipzig. Price 12 marks.

The fourth edition of this well-known work has been revised by Professor Emde. It was printed and being bound for issue in 1944, but the whole edition was destroyed by bomb and fire damage, and has had to be reprinted. Among the additional matter in this new edition are an extension of the table of the error integral, a table of functions of the parabolic cylinder, also of Laguerre function, of spherical harmonics of the second kind, and of the incomplete Anger and Weber functions. One of the tables of Bessel functions has been replaced by a more correct table, and formulae and figures are given for the use of Debye's convergently beginning series for the Bessel functions with complex argument and order. A number of corrections have been made and supplements added.

As in the earlier editions, the book is bilingual, everything being given in both German and English.

G. W. O. H.

Tables of Elementary Functions

By Fritz Emde. Second Edition. Pp. 181 + xii with 83 illustrations. B. G. Teubner Verlagsgesellschaft, Leipzig. Price 12 Marks.

Like the fourth edition of the Tables of Higher Functions, this would have been published in 1944, but the whole edition was destroyed at the bookbinders by war damage and has had to be reprinted.

This is almost a reproduction of the first edition of 1940. Before that date all the Tables, both elementary and higher, were in one volume but Professor Emde wisely decided to divide it into two parts, Elementary and Higher, and the first 78 pages of the old Jahnke-Emde volume were removed in 1940, and made the basis of this new volume. It goes as far as hyperbolic functions of a complex variable, Chebyshev's polynomials, and Planck's radiation function, but does not contain such things as elliptic and Bessel functions; they are dealt with in the other volume.

Everything is given in both German and English. In addition to the Tables, there is much descriptive matter showing the development of the formulae, and, wherever they are of any help, graphs and relief diagrams are given.

G. W. O. H.

International Radio Tube Encyclopedia

Edited by Bernard R. Babani. Pp. 410 + lxxxiv, Bernards Ltd., The Grampians, Western Gate, London. W.6. Price 42s.

This book gives characteristics of some 15,000 valves. The data is presented in tabular form and the valves are grouped under the headings: Radio Receiving Tubes; Triode Transmitting Tubes; Transmitting Tetrodes; Pentodes and Other Transmitting Tubes having more than Five Elements; Rectifiers; Thyratrons; Regulator and Control Tubes; Tuning Indicators; Cathode-Ray Tubes; Photo Tubes; and Rare Tubes and Their Equivalents. Under each heading the valves are arranged in alphabetical and numerical order.

Given its type number, it is easy to turn up the characteristics of any valve. The book, however, does not enable the inverse operation to be carried out; one cannot determine from it, without a prohibitively laborious search, what valves exist with given characteristics. The data includes the usual characteristics, such as, typical operating voltages and currents, a.c. resistance, amplification factor, mutual conductance, load resistance, cathode-bias resistance and base connections. In addition to British, American and Continental commercial types, British and American Service valves are included.

The base connections are given in tabular form with the other data and for identification purposes there are several pages of base drawings. These could be improved, for the differences between different types are not always adequately shown. The base designations, too, are not always the standard ones; thus, the UX bases do not appear as such but have names like USG7, USM7B, etc.

W.T.C.

Radio Engineering. (Volume 2).

By E. K. Sandeman, Ph.D., M.I.E.E. Pp. 579+xxi. Chapman & Hall, Ltd., 37, Essex St., London, W.C.2. Price 40s.

This second half of the work retains in full measure the inconsistencies of style and presentation of the first, while the material presented is less easy to commend. The subject matter includes interference and noise, receivers, measuring equipment, equalizer design, feedback, network theory, and filters. There are in addition 104 pages of appendices, including a large collection of formulae and information on a variety of subjects, such as tuning methods, special network problem, Fourier analysis, etc. A bibliography occupies 75 pages. The index to the whole work, given in Vol. 1, is repeated, and so is the whole preface, in which the author claims the book to be suitable not only for experienced engineers but for complete novices. Although a period of nearly two years has elapsed between publication of the volumes, there are no corrections to Vol. 1.

As before, the applicability of the test to radio engineering outside the B.B.C. is purely coincidental. In fact, the section on the testing of receivers has the appearance of being an unedited B.B.C. departmental order. Apart from this section, the treatment of receivers extends to only 40 pages being, as the author explains, largely from the viewpoint of the user. It is a pity he did not adhere more strictly to his intention to keep off receiver design, for it is clearly not his metier. For example, after mentioning the types of aerial coupling primary that resonate respectively above and below the working waveband, he states that a primary resonating within the waveband "has application only to special cases of receivers designed to receive a particular frequency, but is described immediately below because it is the most simple method to apply and one which will probably be of most use to engineers other than designers of receiving sets"! He then proceeds to describe it in relation to a receiver tuning from 200 to 600 metres, remarking finally that because its efficiency is not well maintained over this waveband the other methods (not described in detail) are preferred.

The circuit taken to illustrate simple a.v.c. as distinct from delayed a.v.c. is unfortunate for the purpose, since (apparently unperceived by the author) an initial negative bias is applied to the a.v.c. anode. In describing another circuit the author admits that it is not clear why two of the components cannot be eliminated. Surely, however, he ought to confine his explanations to circuits about which he is quite clear. Elsewhere, in connection with r.f. amplification, one is given the impression that the use of pentodes to render neutralization unnecessary is quite a recent development, and so is the replacement of thermocouples in a.f. meters by copper-oxide rectifiers.

A detailed treatment of diode voltmeters for measuring high r.f. voltages in transmitters is an original feature of the chapter on measuring equipment, and it is a pity that it is not more lucid. The sections on a.f. bridges are poor, and made worse by misprints. Some attention is given to the measurements of harmonics, but intermodulation products are so studiously ignored that even the General Radio Co's Wave Analyzer is called a "Harmonic Analyser."

As in Vol. 1, the author shows most enthusiasm in dealing with circuit calculations. It is doubtful, however, whether his readers will share his enthusiasm for some of his methods. After quite a helpful section on general methods of network analysis, he launches a 'simplified' system of dealing with four-terminal networks. To avoid using hyperbolic functions, of which (he says) no satisfactory tables exist, he invents and defines a new set of functions, denoted by 'sins,' 'coss,' 'tans' etc. The definition is the last one sees of them, until their reappearance among the other formulae in the first appendix. The terms 'unsymmetrical,' 'asymmetrical,' and 'dissymetrical' are used, but their distinctions are not made clear. After an alternative solution of the symmetrical bridged-T by matrices, there follow 33 pages on the method of matrices, which will be of special interest owing to the scarcity of such information in English.

In contrast to all this theory, and not explicitly related to it, the chapter on filters is a set of design rules, the nucleus being a number of tables reproduced from American books.

The author frankly disclaims that the extensive bibliography is complete or systematic, and one cannot but concur with him. For example, while there are 91 references on aerials and 45 on noise there are 2 on distortion, one of them being "The Buzz Effect in Pentodes" from the June 1938 issue of this journal. There are no references to valve voltmeters, although the treatment in the book itself is confined almost exclusively to the one special type mentioned above.

The lack of care taken to achieve clarity in exposition is revealed also in details such as consistency of symbols. In the chapter on feedback in amplifiers, the symbol u is used not only with its accepted meaning but also with two other meanings. The use of L to denote impedance is another disconcerting peculiarity. When an abbreviation such as 'i.f.' has been adopted, it is difficult to see why it should be considered necessary in addition to write out the word 'frequency' in full, as is consistently done. Within a few pages, 'c/s' 'cycles' and 'p:s' are used apparently to mean the same thing. 'Schottky,' 'Schroteffekt,' and 'Lissajous' are mis-spelt.

Unfortunately these are only a few of the examples that could be quoted, and it is to be hoped that before being reissued the text will be carefully revised.

M. G. S.

Fundamentals of Radio-Valve Technique

By J. Deketh. Pp. 535 + xxii. Cleaver-Hume Press Ltd., 42a, South Audley St., London, W.1. Price 35s.

This book is the first of a series dealing with valves and their applications and is published by N. V. Philips' Gloeilampenfabrieken, Eindhoven.

It opens with chapters describing the basic principles of the action of the valve, the physical concepts of electrons and electric currents, the behaviour of electrons in electrostatic and magnetic fields, and electron emission, both primary and secondary. The components, construction and manufacture of valves are then treated. All this occupies some 100 pages.

The functions of valves, their symbols in circuit diagrams and their classification are next dealt with. Valve characteristics are then given a chapter and followed by an explanation of how the various grids affect them. Inter-electrode capacitance, the curvature of the characteristics and its representation by an exponential series are covered.

The remainder, rather more than one-half of it, is devoted to valves in circuits. Amplifiers, rectifiers and oscillators are described as well as frequency-changers, a.g.c., negative feedback, noise, s.w. properties of valves, microphony, etc.

The book concludes with Appendices covering units, elementary d.c., a.c. and oscillatory-circuit formulae, universal curves of band-pass filters, skin effect, calculation of inductance and capacitance and various tables and graphs.

An enormous amount of material is included in the book. On the whole the treatment is fairly elementary and involves little more than simple mathematics, and not a great deal of that. It is profusely illustrated with circuits, graphs and valve characteristics and there are many exceedingly good diagrams illustrating equipotential lines in valves.

As might be expected from the origin of the book all the valves quoted as examples are Philips' types. This is not a serious drawback but the book does suffer slightly from the fact that the techniques described are also largely confined to Philips' practice.

Symbols and nomenclature often follow Continental rather than British practice. The translation is exceedingly good, although some peculiarities of expression have crept in.

The book is more suited to the student than the engineer, but the latter will undoubtedly find parts of it useful for reference.

W. T. C.

Laboratory and Workshop Notes

Compiled by Ruth Lang, Ph.D., A.Inst.P. Pp. 272 + xii. Edward Arnold & Co., 41, Maddox St., London, W.1. Price 21s.

Atmospheric Turbulence

By O. G. Sutton, B.Sc. Pp. 107 + vii. Methuen & Co., Ltd., 36, Essex St., Strand, London, W.C.2. Price 6s.

WIRELESS PATENTS

A Summary of Recently Accepted Specifications

The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specificatioes obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 2/- each.

ACOUSTICS AND AUDIO-FREQUENCY CIRCUITS AND APPARATUS

625 291.—A ribbon microphone wherein the pole pieces comprise stacks of laminations shaped to provide air passages to give a directional effect.

The B.T.H. Co., Ltd., and W. A. Bocock. Application date November 7th, 1946.

625 563.—Electromagnetic disc recording or reproduction of sound using a magnetizable needle within a coil with a closed magnetizable casing surrounding them, with a small hole for the needle.

The British Thomson-Houston Company Ltd. Convention date (U.S.A.) January 9th, 1945.

625 744.—A rainproofing screen for a microphone of closely woven material with filaments 0.0075 in or less; e.g., umbrella silk or stainless steel.

Standard Telephones and Cables Ltd., W. D. Cragg and M. L. Gayford. Application date October 2nd, 1946.

626 912.—A sound amplification or loud-speaking telephone using two channels of different phase displacement characteristics, the output to the transmitter being taken therefrom in continually changing manner to promote stability.

Standard Telephones and Cables Ltd., S. S. Hill and W. D. Cragg. Application date January 14th, 1947.

DIRECTIONAL AND NAVIGATIONAL SYSTEMS

625 034.—A p.p.i. radar display wherein echo signals beat with a reference oscillation to give a 'striated' display, the slope of which depends on rate of approach by Doppler effect.

W. S. Elliott. Application date May 31st, 1946.

625 734.—The indication on aircraft of the positions of beacons and an obstacle is obtained by the synchronized rotation of slotted discs in front of selectively operable ring-shaped discharge lamps.

Standard Telephones and Cables Ltd. (assignees of H. G. Busignies). Convention date (U.S.A.) June 30th, 1945.

625 891.—Blind-landing system in which the aircraft equipment is automatically adjusted according to distance for guiding the craft on a different course from a transmitted beam.

A. C. Cossor Ltd. and L. H. Bedford. Application date June 28th, 1945.

RECEIVING CIRCUITS AND APPARATUS

(*See also under Television*)

625 121.—Frequency changer for 600-Mc/s receiver comprising a double diode or double triode using two sets of tuned transmission lines to which the signal and the local oscillator are coupled.

Sylvania Electric Products Inc. Convention date (U.S.A.) February 14th, 1942.

625 258.—'Exalted-carrier' receiver having two i.f. channels, one of which provides a frequency-controlling potential for a local oscillator and the other is a demodulation channel.

Marconi's Wireless Telegraph Co. Ltd. (assignees of M. G. Crosby). Convention date (U.S.A.) February 14th, 1945.

625 358.—A frequency changer especially for radio-link repeater stations, with two local oscillators to permit amplification at a low i.f. and re-transmission at a slightly different radio frequency from the received frequency.

The General Electric Company Ltd. and R. J. Clayton. Application date June 24th, 1947.

625 436.—Receiver tuning indicator comprising parallel transparent strips each with an end-illuminating lamp at one end.

The General Electric Company Ltd., F. N. Garthwaite, E. Wilson and C. W. M. Read. Application date August 7th, 1946.

625 449.—Receiver for phase or frequency-modulated signals in which false tuning is avoided by a muting circuit operative except when tuned to the mid-band point.

Marconi's Wireless Telegraph Company Ltd. (assignees of A. Wright). Convention date (U.S.A.) November 6th, 1945.

625 908.—Multi-range oscillator for a superheterodyne receiver using a multi-electrode valve to provide two independently operable oscillator circuits, the two circuits having different frequency ranges.

Radio Corporation of America. Convention date (U.S.A.) August 1st, 1945.

625 968.—Permeability-tuned circuit having primary and secondary windings and a movable core, the secondary circuit being tuned by said core and the primary winding having a shunt capacitor.

The British Thomson-Houston Company Limited. Convention date (U.S.A.) January 19th, 1945.

RECEIVING CIRCUITS AND APPARATUS

FOR TRANSMISSION AND RECEPTION

624 896.—A viewing unit for use remotely from a television receiver in which the c.r.t. is positioned face downward and viewed through an adjustable mirror.

H. Ibbotson. Application date February 20th, 1947.

624 983.—Colour television in which four colour component images are sequentially scanned, transmitted, reproduced and recombined by optical means.

G. E. Sleeper Jr. Convention dates (U.S.A.) February 5th and August 30th, 1943.

SUBSIDIARY APPARATUS AND MATERIALS

623 029.—Measuring wave power in a hollow guide by collectors positioned to collect in-phase voltages and anti-phase voltages proportional to electric intensity and to magnetic intensity respectively, and feeding square-law rectifiers.

Standard Telephones and Cables Ltd. (assignees of Le Material Telephonique, Socièté Anonyme). Convention date (France) June 30th, 1943.

624 257.—Piezo-electric crystal mounting wherein the crystal is in an evacuated bulb and has an electrode coating engaged by curved resilient conducting wires.

Western Electric Co. Inc. Convention date (U.S.A.) June 5th, 1940.

ABSTRACTS and REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

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ACOUSTICS AND AUDIO FREQUENCIES

534.213.4 **1**

On the Radiation of Sound into a Circular Tube.—U. Ingård. (*Chalmers tekn. Högsk. Handl.*, 1948, No. 70, 49 pp. In English.) A study of the propagation of sound waves in rigid-walled tubes from sound sources of circular symmetry, in particular a plane piston source. The radiation resistance and the pressure distribution in the tube are calculated, and verified by measurements. The equivalent circuit is discussed. The case of a cylindrical resonator is considered, and curves are given for calculated and measured resonance frequencies.

534.756 + 621.39 **2**

Relationship between Rate of Transmission of Information, Frequency Bandwidth, and Signal-to-Noise Ratio.—Earp. (*See* 62.)

534.78 **3**

A Playback for Visible Speech.—L. O. Schott. (*Bell Lab. Rec.*, Aug. 1948, Vol. 26, No. 8, pp. 333–339.) Description of a rotatable frosted lucite drum and associated photoelectric equipment which reproduces speech from opaque patterns on the surface of the drum.

534.842 : 791.45 **4**

Auditorium Acoustics.—J. P. Maxfield. (*J. Soc. Mot. Pict. Engrs*, Aug. 1948, Vol. 51, No. 2, pp. 169–176. Discussion, pp. 176–183.) A review of the factors affecting the acoustic properties of auditoria, with special reference to the cinema.

534.844.1 **5**

Measuring Reverberation Time by the Method of Exponentially Increasing Amplification.—W. Tak. (*Philips tech. Rev.*, 1947/1948, Vol. 9, No. 12, pp. 371–378.) Periodic sound impulses are generated within the space whose reverberation time is to be measured and the voltage from a microphone within this space is applied, after exponential amplification, to a c.r.o. The amplification of each pulse voltage begins with a low value, rises exponentially to 60 db, and then drops back to the initial low value. When the sweep period is equal to the reverberation time, the oscillogram has an approximately constant amplitude. The equipment is described and experimental results are discussed.

534.844.1 : 621.385.832 **6**

Reverber-O-Graph (An Electronic Reverberation Recorder).—N. B. Bhatt & D. L. Subrahmanyam. (*Electrotechnics*, March 1948, No. 20, pp. 47–54.) A portable mains-operated recorder which indicates the decay of sound intensity in rooms in decibels per second on the screen of a c.r. tube of long persistence. The sweep time can be 1, 2, 3, 5 or 7 sec, so that the reverberation times of rooms of any size can be determined. A logarithmic amplifier stage enables a range of sound intensity of 75 db to be recorded either by tracing or by photographic means. Full circuit details are given, with examples of typical sound decay curves.

534.845 **7**

Behavior of Acoustic Materials.—R. K. Cook. (*J. Soc. Mot. Pict. Engrs*, Aug. 1948, Vol. 51, No. 2, pp. 192–200. Discussion, pp. 200–202.) The mechanism of absorption in various materials is discussed and methods for determining normal-incidence and random-incidence absorption coefficients are outlined. The latter coefficient is considered the more useful in auditorium design. Recommendations for painting acoustic materials are made and the results of such painting are illustrated.

534.862 : 621.396.662.3.029.3 **8**

Continuously Variable Band-Elimination Filter.—Singer. (*See* 59.)

621.395.616 **9**

Circuit for Condenser Microphones with Low Noise Level.—J. J. Zaalberg van Zelst. (*Philips tech. Rev.*, 1947/1948, Vol. 9, No. 12, pp. 357–363.) The microphone is incorporated in a bridge circuit which, as the diaphragm vibrates, supplies an a.m. high-frequency voltage, which is amplified and detected. The bridge circuit can be connected to the amplifier by a cable, and a high resistance in series with the microphone is not required.

621.395.616 : 534.76 **10**

A Condenser-Microphone for Stereophony.—A. Rademakers. (*Philips tech. Rev.*, 1947/1948, Vol. 9, No. 11, pp. 330–338.) The requisites for such a microphone are discussed and the construction of the instrument used in Philips' laboratory is described. This instrument has a diaphragm of effective diameter about 15 mm and of thickness $15\ \mu$, whose natural frequency is raised to 12 000 c/s by using the 'stiffness' of the air cushion between it and the back electrode $13\ \mu$ away. The resonance peak is eliminated by air-damping, so that the response is flat, to within 2 db, up to 14 000 c/s. The threshold value is below 30 phons and the sensitivity with an applied direct voltage of 100 V is 3 mV/μbar.

621.395.625 : 621.396.97 **11**

Sound Recording as applied to Broadcasting.—M. J. L. Pulling. (*B.B.C. Quart.*, July 1948, Vol. 3, No. 2, pp. 108–121.) A technical discussion of the methods used by the British Broadcasting Corporation. Mechanographic methods using disks or film are compared with magnetic systems using tape or wire, with special reference to the difficulties associated with editing and continuous recording and reproduction. The requirements for both static and transportable equipment are considered and the need for international standards of recording is mentioned. No single existing system meets all requirements.

621.395.625.3 **12**

The "Edispot": A Spotting Device for Magnetic Tape-Editing.—R. S. O'Brien. (*Audio Engng, N.Y.*, July 1948, Vol. 32, No. 7, pp. 11–13, 46.) Provides means for winding, timing and playback. An auxiliary rotating drum and pickup head enable a small portion of the tape to be examined continuously, either aurally or by c.r.o. display, so that any particular section of a record can be located accurately.

AERIALS AND TRANSMISSION LINES

621.315.212 : 621.3.09 **13**

Propagation of Electromagnetic Waves in Concentric Wide-Band Cables with Longitudinal Dielectric Spacers.—H. Buchholz. (*Arch. elekt. Übertragung*, Sept./Oct. 1947, Vol. 1, Nos. 3/4, pp. 137–150.) The mathematical treatment is simplified by considering the analogous case of propagation in the rectangular channels between uniformly distributed dielectric spacers between two plane-parallel plates. Two solutions are obtained by combining the E and H fields. Critical frequencies and the propagation constant are calculated and shown graphically. The characteristics of the magnetic field, the low losses due to current heating, and attenuation are also investigated.

621.315.212 : 621.3.09 **14**

Attenuation and Phase Distortion due to Internal Irregularities and Repeater Mismatch of Coaxial Cables.—G. Fuchs. (*Câbles & Transmission, Paris*, July 1948, Vol. 2, No. 3, pp. 233–241. With English summary.)

621.315.212 : 621.317.336 **15**

Study of the Impedance Irregularities of Coaxial Cables by Oscillographic Observation of Pulse Echoes.—Couanault & Herreng. (*See* 142.)

621.392.029.64 **16**

TM$_{0,1}$ Mode in Circular Wave Guides with Two Coaxial Dielectrics.—S. Frankel. (*Elect. Commun.*, June 1948, Vol. 25, No. 2, pp. 152–157.) Reprint of 22 of 1948.

621.392.029.64 : 621.315.61 **17**

Fields in Nonmetallic Waveguides.—R. M. Whitmer. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1948, Vol. 36, No. 9, pp. 1105–1109.) Green's function is found for an infinite plate of dielectric material having the electric field parallel to the surfaces of the plate. The solution is found as a Fourier integral which is then replaced by a complex contour integral. The residues at the real poles, of which there are a finite number, correspond to the propagating modes in a metallic waveguide. An integral around a branch cut gives a wave radiating into space, analogous to the attenuated modes of the metallic guide.

The modal field distributions are discussed for the plate and for circular rods. The surface fields are not small, but are attenuated transversely at rates $\geqslant 28$ db per radius. A nonmetallic waveguide can be useful wherever a cheap flexible conductor is needed and imperfect shielding can be tolerated.

621.396.67 : 621.317.336 **18**

Television Receiving Aerials: Impedance Measuring and Matching Methods.—D. A. Bell. (*J. Brit. Instn Radio Engrs*, Jan./Feb. 1948, Vol. 8, No. 1, pp. 19–39. Discussion, pp. 39–40.) Describes impedance measurement by observation of standing-wave patterns and the use of circle diagrams, and also by the substitution method. Wide-band matching devices, the use of fractional-wavelength lines as transformers, and balance/unbalance converters are briefly mentioned.

621.396.67 : 621.397.743 **19**

Television Antenna and R.F. Distribution Systems for Apartment Houses.—Kallmann. (*See* 243.)

621.396.677 **20**

Fed-Dipole Groups as Longitudinal Radiators for Broad Frequency Bands.—O. Zinke. (*Funk u. Ton*, Sept. 1948, Vol. 2, No. 9, pp. 435–442.) Arrangements of dipoles in line, with separations reduced according to a certain law, are shown to give beams 30 to 45% narrower than other array systems and cover a 3 : 1 frequency range. For a given half-value width of the radiation diagram a Yagi aerial is 2–3 times longer than a longitudinal radiator of the new type with alternate fed and reflector dipoles. The new type corresponds in its operation to the dielectric directional arrays of Mallach and extends these for $\lambda > 50$ cm. Typical radiation diagrams are given.

621.396.677 **21**

A Discussion of the Maximum Directivity of an Antenna.—T. T. Taylor. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1948, Vol. 36, No. 9, p. 1135.) Comment on 2731 of 1948 (Riblet). It is shown that as the diameter of a sphere, corresponding to the aperture of a broadside array, is reduced below 50λ, the radiation Q, which is the ratio of the energy stored in the intense portion of the induction field to the radiated energy, increases at an exceptionally high rate. In consequence, critical tolerance and bandwidth as well as ohmic loss are important limitations in the design of superdirective aerials. The mathematical basis is outlined and examples are given.

621.396.677 **22**

The Maximum Directivity of an Antenna.—D. A. Bell. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1948, Vol. 36, No. 9, p. 1134.) Discussion on 2731 of 1948 (Riblet).

621.396.677 **23**

An Experimental Investigation of the Radiation Patterns of Electromagnetic Horn Antennas.—D. R. Rhodes. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1948, Vol. 36, No. 9, pp. 1101–1105.) 250 radiation patterns are shown for rectangular horns, as functions of the electric- and magnetic-plane flare angles (from 0° to 50°) and of the radial length of the horn (from 0 to 50λ). Characteristic properties are thus revealed; their effect on the design of such horns is discussed.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.018.41 **24**

Negative Frequency.—" Cathode Ray ". (*Wireless World*, Oct. 1948, Vol. 54, No. 10, pp. 361–364.) The distinction between positive and negative frequencies is discussed for 2-phase supply, and negative frequency is considered in relation to modulation and frequency changing. A 2-phase method of eliminating second-channel interference, discussed fully by Barber (2697 of 1947) is briefly explained. See also 1866 of 1948 (Madella) and 1867 of 1948 (Barber).

621.314.632 : 621.396.622.63 **25**

Applications of Crystal Rectifiers at Frequencies up to 10 000 Mc/s.—J. H. Evans. (*J. Brit. Instn Radio Engrs*, May/June 1948, Vol. 8, No. 3, pp. 112–121. Discussion, pp. 121–125.) The construction and general mechanical details of crystal rectifiers are described. Various applications considered include frequency changing and detection in microwave receivers, and l.f. rectification for meters.

621.316.726.078.3 : 621.396.615 : 621.396.619.13 **26**

Simplified Automatic Stabilization of a Frequency-Modulated Oscillator.—J. L. Hollis. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1948, Vol. 36, No. 9, pp. 1164–1171.) A quartz-crystal discriminator is operated at the frequency of the modulated oscillator, so that heterodyning and mixing circuits are unnecessary. A special bridge circuit, operating on the modulator bias, maintains the average frequency equal to the mean frequency of the discriminator. The circuit arrangements are described ; the performance and stability of a complete unit are briefly discussed.

621.316.86 **27**

Fixed High-Stability Carbon Resistors.—T. Holmes. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 912–914.) Discussion of manufacturing problems. Ceramic rods are coated with a carbon film by pyrolitic decomposition of methane in a continuous-process furnace. The resistance is increased by cutting a spiral track on the coated surface. The ends are coated with graphite for good contact with the metal end caps which are then fitted. The whole resistor is given a lacquer finish. The furnace and its control characteristics are described. Typical stability figures for the resistors are tabulated.

621.316.89 **28**

Production of Frequency-Independent Purely Ohmic Resistors for Short Waves.—W. Burkhardtsmaier. (*Funk u. Ton*, Aug. 1948, Vol. 2, No. 8, pp. 381–391.) A device is described whose input resistance remains equal to its d.c. value up to very high frequencies. The limiting frequency depends on the length of the resistor used. The device resembles that of Roosenstein (137 of 1944) and has a concentric return conductor. It is particularly suitable for use in compensation circuits, whose design is discussed.

621.318.42 **29**

Contribution to the Calculation of Premagnetized Choke Coils.—J. Kammerloher. (*Funk u. Ton*, Sept. 1948, Vol. 2, No. 9, pp. 443–453.) The effective core-permeability of such chokes is defined and methods for calculating it are given, with relevant formulae and numerical examples.

621.318.572 **30**

An Electronic Switch with Variable Commutating Frequency.—E. E. Carpentier. (*Philips tech. Rev.*, 1947/1948, Vol. 9, No. 11, pp. 340–346.) Details of an instrument suitable for the simultaneous production of two oscillograms, and with switching rate continuously variable from 2 to 40 000 per sec.

621.318.572 : 621.396.96 **31**

The Strobe Principle in Radio and Radar.—L. H. Bedford. (*J. Brit. Instn Radio Engrs*, March/April 1948, Vol. 8, No. 2, pp. 62–70.) A concise theoretical explanation, with discussion of various practical circuits.

621.392 **32**

Network Transformations.—(*Distrib. Elect.*, Oct. 1948, Vol. 21, No. 172, pp. 40–43.) A collection of formulae for (*a*) series-parallel transformations for resistances and for impedances, (*b*) star-delta and derived transformations for impedances and admittances, with simple numerical examples, some of which involve negative components.

621.392 **33**

Dual Circuits.—W. Klein. (*Funk u. Ton*, Aug. 1948, Vol. 2, No. 8, pp. 392–395.) Methods are known for deriving dual, or inverse, circuits for plane networks. With the help of two dual potential decoupling arrangements, which consist of ideal transformers with a 1 : 1 transfer ratio, an equivalent plane network can be obtained for any network and a dual network can then be derived.

621.392 **34**

Three Investigations on the Pulling of Oscillations.—H. G. Möller. (*Elektrotechnik, Berlin*, Sept. 1947, Vol. 1, No. 3, pp. 65–71.) Theory is given of the pulling phenomena for two self-oscillating systems. The theory is based on two fundamental equations, one representing the resultant oscillation and a nonlinear one representing the amplitude limitation in the self-oscillating systems. Confirmation of the theory is given by the results of researches on (*a*) the energy transfer between two valve transmitters with different amplitudes, (*b*) the current in the coupling conductor, and (*c*) the transition from the heterodyne to the pulling regime.

621.392 : 621.385.5.001.8 **35**

Applications of Screen-Grid Supply Impedance in Pentodes.—Sulzer. (*See* 258.)

621.392.015.3 : 537.311.5 : 517.941 **36**

The Determination of the Integration Constants when Calculating Transient Phenomena.—B. D. H. Tellegen. (*Philips Res. Rep.*, Feb. 1948, Vol. 3, No. 1, pp. 24–36.) " A network is considered containing a voltage source v under the influence of which a current i flows in a certain branch. A method is given for calculating, from the differential equation connecting i and v, the discontinuities in i and its derivatives resulting from discontinuities in v and its derivatives. The method is applied to the calculation of periodic phenomena caused by periodic sources containing discontinuities."

621.392.43 **37**

Antenna Matching with Line Segments.—J. G. Marshall. (*QST*, Sept. 1948, Vol. 32, No. 9, pp. 18–21 . . 104.) Simple design formulae, for series- or shunt-balanced networks using a section of transmission line as a transformer, are derived for the general case when each element of the network may have a different characteristic impedance.

621.392.5 **38**

Delay Networks from Low-Pass Units.—J. Linke. (*Elektrotechnik, Berlin*, Aug. 1947, Vol. 1, No. 2, pp. 43–51.) The transmission characteristics of low-pass filters of various types are discussed, with special reference to their use in the construction of delay networks. Designs are given for low-pass delay networks with given damping and characteristic impedance, and the behaviour of these networks is compared with that of networks constructed from phase-rotation units.

621.392.5 : 621.385.029.63/.64 **39**

Experimental Method for *a priori* Tests of Delay Lines for the Travelling-Wave Amplifier.—P. Lapostolle. (*C. R. Acad. Sci., Paris*, 9th Aug. 1948, Vol. 227, No. 6, pp. 388–389.) In the calculation of the gain of the amplified wave, the part of the delay line outside the beam only involves a single coefficient P, which is a measure of the amplification efficiency. Details and theory are given of a method for determining P, in which the electron beam is replaced by a cylindrical rod of dielectric which retards the waves. The retardation can be very easily expressed in terms of P. See also 2325 of 1947.

621.392.5.012 **40**

On the Amplitude Curve associated with a Linear Phase Characteristic in a Quadripole with Minimum Dephasage.—J. Laplume. (*C. R. Acad. Sci., Paris*, 19th July 1948, Vol. 227, No. 3, pp. 187–188.) The curve representing the amplitude response of such a quadripole is determined for the case where the dephasage is rigorously linear between two finite limits and constant outside these limits. The gain curve has a maximum at a frequency equal to the geometric mean of the limits ; it falls off more rapidly towards the high than towards the low frequencies. Between the limiting frequencies the curve is rounded, in contrast to the flat characteristic often aimed at in design.

621.394/.395].645 : 621.394/.395].73 **41**

Line Amplifier for the Paris-Toulouse Coaxial Cable.—Sueur. (*See* 212.)

621.395.665.1 **42**

Surgeless Volume Expansion.—A. A. Tomkins. (*Wireless World*, Sept. 1948, Vol. 54, No. 9, p. 347.) Corrections to 2739 of 1948.

621.396.611.1 **43**

Building-Up Processes in Two Coupled Linear Oscillatory Systems with Arbitrary Damping and Type and Magnitude of Coupling.—P. Schneider. (*Arch. elekt. Übertragung*, Sept./Oct. 1947, Vol. 1, Nos. 3/4, pp. 91–100.) The essential feature of the investigation is the calculation of the biquadratic Heaviside function of the system of simultaneous homogeneous differential equations of the free oscillations, by a method previously described (2627 of 1942). Three cases are considered, depending on the value of the damping. In the lower range two pairs of conjugate complex roots are found, in the middle range one pair of conjugate complex roots and two real roots, and in the upper range four real roots. These correspond respectively to (*a*) two oscillatory, (*b*) one oscillatory and one aperiodic, (*c*) two aperiodic phenomena. An equivalent circuit is used in the discussion of general coupling relations. The Laplace transformation is found particularly suitable for the investigation of building-up effects. The calculations are applied to the two important practical cases of excitation by a damped sinusoidal voltage or by a surge voltage, for arbitrary initial conditions and different degrees of damping.

621.396.615 **44**

Theory of Amplitude-Stabilized Oscillators.—P. Aigrain & E. M. Williams. (*Rev. sci., Paris*, 15th Aug. 1947, Vol. 85, No. 3279, pp. 839–846.) For other accounts see 980 and 1883 of 1948.

621.396.615 **45**

A Phase-Shift Oscillator with Wide-Range Tuning.—G. Willoner & F. Tihelka. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1948, Vol. 36, No. 9, pp. 1096–1100.) An oscillator covering the frequency range 100–10 000 c/s. The phase of the feedback is controlled by the delay in a 3-terminal all-pass network. The tuning is achieved by varying a single resistance element of the network.

621.396.615 **46**

Positive-Grid Oscillators.—A. V. J. Martin. (*Radio tech. Dig., Édn franç.*, June/Aug. 1948, Vol. 2, Nos. 3/4, pp. 135–143.) Simple explanation of basic principles with formula for oscillation frequency.

621.396.615 **47**

On a Double-Triode Oscillator and its Application to the Study of Dielectrics.—R. Létienne. (*C. R. Acad. Sci., Paris*, 30th Aug. 1948, Vol. 227, No. 9, pp. 506–508.) A modified Franklin oscillator, with multivibrator locked by an oscillatory circuit and with cathode coupling and an amplitude limiter. Stability of frequency is of the same order as that of a crystal oscillator without a thermostat. With coils of good quality the amplitude remains constant over a wide range of frequencies and the harmonic content is negligible. Calibration varies little with the age of the valves. With this type of oscillator, the two-oscillator method for the measurement of dielectric constants can be used for both low-loss and lossy materials.

621.396.615 **48**

Application of Tube 833-A as Ultra High Frequency Oscillator.—S. K. Chatterjee & B. V. Sreekantan. (*Electrotechnics*, March 1948, No. 20, pp. 55–63.) Experimental investigation of the behaviour of this valve when used as a resonant line oscillator to generate frequencies from 26.5 Mc/s to 210 Mc/s. Results are shown graphically and tabulated ; efficiency falls off sharply for frequencies above 60 Mc/s or transit angles above 30°.

621.396.615 : 621.394.441 **49**

Stabilized Oscillator for Multiplex Voice-Frequency Telegraphy.—Delyon & Manière. (*See* 209.)

621.396.615.17 **50**

On the Performance of the Push-Pull Relaxation Oscillator (Multivibrator).—R. Feinberg. (*Phil. Mag.*, April 1948, Vol. 39, No. 291, pp. 268–281.) A mathematical analysis of the multivibrator, based on the assumption that it acts as a 2-way electronic switch which periodically charges and discharges two capacitors in alternate sequence. A linear relation is introduced as an approximate equivalent for the nonlinear valve characteristics. Calculated frequencies agree within 1–15% with experimental values.

621.396.615.17 : 621.319.55 **51**

Electrical Sawtooth Oscillations : Part 2.—H. Hertwig. (*Funk u. Ton*, Sept. 1948, Vol. 2, No. 9, pp. 469–474.) Practical circuits are given for oscillators using gas-discharge valves, with technical data for suitable valves : Philips 4686 and EC50, AEG S1/0, 2iIA and S1/0,2iII. Part 1, 3056 of 1948.

621.396.615.17/.18 **52**

High-Ratio Multivibrator Frequency Divider.—M. Silver & A. Shadowitz. (*Elect. Commun.*, June 1948, Vol. 25, No. 2, pp. 160–162.) The capacitor between the first grid and the second anode of a multivibrator divider is removed and replaced by a high-Q tuned circuit followed by a two-stage clipper. The circuit will now only oscillate in the immediate vicinity of the resonant frequency of the tuned circuit. At the output, a square wave is obtained at this frequency, which is arranged to be the required sub-harmonic of the synchronizing frequency. A circuit is shown that gives stable division ratios as high as 300 to 1. See also 1488 of 1946 (Applegarth) and 3252 of 1941 (Builder).

621.396.615.18 **53**

Frequency Division.—J. Grosskopf. (*Fernmeldetech. Z.*, Aug. 1948, Vol. 1, No. 5, pp. 113–119.) A review of the characteristics of modern frequency dividers of the regenerative-modulation type considered by Miller (3687 of 1939) and the quasi-stable type discussed by Fortescue (3099 of 1939), with particular reference to the pulling-in region and division ratio. See also 3490 of 1938 (Hudec) and 3491 of 1938 (Golicke).

621.396.645 + 621.396.828.1 **54**

Reducing Heater Hum.—K. G. Britton. (*Wireless World*, Oct. 1948, Vol. 54, No. 10, p. 360.) An appropriate proportion of the heater voltage is injected into each valve in antiphase to the hum, which is thus reduced below the level of valve noise. See also 1689 of 1947 (Baxandall).

621.396.645 : 621.385.4 **55**

The FP-54 as a Stable Voltage Amplifier.—N. T. Seaton. (*Canad. J. Res.*, July 1948, Vol. 26, Sec. F, No. 7, pp. 302–309.) A simple method is given for operating the FP-54 pliotron as a stabilized amplifier with a grid current $<10^{-17}$ A. The application to the construction of a compact portable electrometer is discussed briefly.

621.396.645.371.029.3 **56**

Negative Feedback Calculations.—E. J. James. (*Wireless World*, Sept. 1948, Vol. 54, No. 9, pp. 326–330.) Simplified design formulae are given, which " enable the person with little mathematical skill or knowledge to design a feedback circuit suitable to his amplifier and his requirements ".

621.396.662 **57**

Stub Tuners for Power Division.—C. E. Smith. (*Communications*, Aug. 1948, Vol. 28, No. 8, pp. 22–23.) An arrangement of concentric-line stub tuners which provides continuously-variable division, between two loads, of the power from a common input, while preserving the correct matching conditions.

621.396.662.3 **58**

Nonsymmetrical Matched Filters.—W. Herzog. (*Arch. elekt. Übertragung*, Sept./Oct. 1947, Vol. 1, Nos. 3/4, pp. 122–127.) Discussion of various nonsymmetrical filter circuits which allow matching within wide limits, with simple design formulae.

621.396.662.3.029.3 : 534.862 **59**

Continuously Variable Band-Elimination Filter.—K. Singer. (*J. Soc. Mot. Pict. Engrs*, Aug. 1948, Vol. 51, No. 2, pp. 203–210.) The filter is essentially a 4-stage zero-gain amplifier incorporating a Wien bridge and with 26-db feedback to give extra steepness of the response curve on both sides of the rejection frequency. This frequency is adjustable from 30 to 9 000 c/s, and 50-db rejection is obtained anywhere in that range, which is covered in 5 overlapping bands. The filter has proved very useful for the elimination of interference frequencies, such as arc whistles, in the production of sound for motion pictures.

GENERAL PHYSICS

53.081.5 : 530.1 **60**

Some Electrical Applications of Dimensional Analysis and of the Principle of Similitude.—L. Lakaye. (*Bull. sci. Ass. Inst. Montefiore*, May/Aug. 1948, Vol. 61, Nos. 5/8, pp. 219–257.) Discussion includes the theory of experiments on reduced-scale models. See also 2504 of 1948 (Dzung & Meldahl) and back references.

530.162 + 621.396.822 **61**

The Brownian Movement and Spontaneous Fluctuation of Electricity.—D. K. C. MacDonald. (*Research, Lond.*, Feb. 1948, Vol. 1, No. 5, pp. 194–203. Bibliography, pp. 203–204.) A historical review of the development of present knowledge of the subject. The principal formulae are given.

534.756 + 621.39 **62**

Relationship between Rate of Transmission of Information, Frequency Bandwidth, and Signal-to-Noise Ratio.—C. W. Earp. (*Elect. Commun.*, June 1948, Vol. 25, No. 2, pp. 178–195.) An integrated modern theory of communication is developed. The exact benefit to be gained by the use of the right balance between rate of transmission of information and the frequency bandwidth used is estimated for the established expanded-band communication systems. The particular features of transmission systems necessary for optimum performance are considered. A new system of modulation, tentatively called ' step modulation ', is shown to have all known characteristics of efficiency. The exact performance of the system is examined and it is found that the process of bandwidth expansion to yield improved demodulated signal/noise ratio may be inverted to provide communication through reduced bandwidth at the cost of signal/noise ratio. The new system may define the theoretical limit of efficient use of frequency bandwidth for any transmission system, for the case when the only known characteristic of the information wave is the frequency band that contains it. See also 1057 of 1947 (Gabor).

535.317.9 : 621.397.5 : 535.88 **63**

The Manufacture of Correction Plates for Schmidt Optical Systems.—H. Rinia & P. M. van Alphen. (*Philips tech. Rev.*, 1947/1948, Vol. 9, No. 12, pp. 349–356.) Discussion of the optics of the Schmidt system, with a method of manufacturing the correction plate. A mould with the thickness dimensions increased in the ratio 5 : 1 is used to form a gelatin plate from a 20% solution, which on drying shrinks to the required thickness, lateral shrinking being prevented by a glass backing plate. See also 2652 of 1948 (Friedman) and 2767 of 1948 (de Groot).

537.21 : 621.385.833 **64**

The Electrostatic Field Distribution near a Circular Aperture or Short Cylinder.—G. Liebmann. (*Phil. Mag.*, April 1948, Vol. 39, No. 291, pp. 281–296.) The potential is the sum of that calculated by Bertram (1215 of 1942) and a correction term. In many cases of interest in electron optics or valve design the correction term is the more important. Both terms are tabulated.

537.228.1 : 621.395.625.6 **65**

Light Modulation by P-Type Crystals.—G. D. Gotschall. (*J. Soc. Mot. Pict. Engrs*, July 1948, Vol. 51, No. 1, pp. 13–20.) The method described uses the linear electro-optic effect in P-type crystals. ' PN ' crystals (dihydrogen ammonium phosphate) give good results. A parallel beam of polarized light is used. Voltages as high as 9 kV may be required, but practically no current is taken. The flat response extends well beyond the audio range. The simple construction, excellent dark-to-light ratio, high input impedance and good transmission characteristics are particularly applicable to variable-density sound-film recording.

537.311.33 : 621.396.645 : 621.315.59 **66**

The Transistor, a Semi-Conductor Triode.—Bardeen & Brattain. (*See* 264.)

537.311.33 : 621.396.645 : 621.315.59 **67**

Experimental Germanium Crystal Amplifier [the Transistor].—Wells : White. (*See* 265.)

537.312.62 **68**

Theory of Superconductivity.—M. Born & Kai Chia Cheng. (*Nature, Lond.*, 19th June 1948, Vol. 161, No. 4103, pp. 968–969.) A correct theory should be based on the ionic forces. Those metals are superconductive for which the Fermi surface, supposed to be a sphere, lies very close to one set of the corners formed by the boundary planes of a Brillouin zone.

537.312.62 : 621.317.332 **69**

High-Frequency Resistance of Superconductors.—A. B. Pippard. (*Nature, Lond.*, 10th July 1948, Vol. 162, No. 4106, pp. 68–69.) Discussion of measurements for Sn at frequencies of about 9 200 Mc/s. See also 1014 of 1948.

537.523.3 **70**

The Influence of Corona Formation upon the Design of High Voltage Apparatus.—W. T. Thornhill & E. W. Beasley. (*Marconi Rev.*, July/Sept. 1948, Vol. 11, No. 90, pp. 87–104.)

537.562 **71**

On the Absorption of the Energy of High-Frequency Currents by Ionized Gases.—V. P. Mihu. (*C. R. Acad. Sci., Paris*, 23rd Aug. 1948, Vol. 227, No. 8, pp. 472–474.) The intensity of the current in a coil forming part of an oscillatory circuit varies with the current intensity in a Geissler tube threading the coil. The absorption of energy by the gas in the tube has a maximum value for a particular gas pressure, which for hydrogen is 0.14 mm Hg and is constant for λ 2.40–5.94 m.

538.221 **72**

On the Interpretation of the Anomalies of Ferromagnetics at Radio Frequencies.—I. Épelboim. (*C. R. Acad. Sci., Paris*, 19th July 1948, Vol. 227, No. 3, pp. 185–187.) The anomalies are related to the existence of strong parasitic currents induced in the surface layers by the underlying layers of higher permeability. No supplementary hypotheses concerning magnetic viscosity appear necessary.

538.567.2 : 621.383.5 **73**

The Photo-Voltaic Effect.—K. Lehovec. (*Phys. Rev.*, 15th Aug. 1948, Vol. 74, No. 4, pp. 463–471.) The Schottky-Mott theory of the barrier-layer rectification is extended with respect to the action of light absorbed in that layer. An ' equation of state ' connecting photo-voltage, photo-current, light intensity, wavelength, external resistance, etc., is derived and discussed.

538.69 : 538.221 **74**

On the Motion of Iron Particles, with Six Degrees of Freedom, in the Air round a Wire carrying a Constant Electric Current.—J. A. Schedling. (*C. R. Acad. Sci., Paris*, 23rd Aug. 1948, Vol. 227, No. 8, pp. 470–472.) An account of effects analogous to those described by Ehrenhaft (2755 of 1947) for uniform magnetic fields.

538.3 **75**

Electromagnetism. [Book Review]—J. C. Slater & N. H. Frank. McGraw-Hill, London, 1947, 240 pp., 17s. 6d. (*Beama J.*, Aug. 1948, Vol. 55, No. 134, p. 266.) " The book is to be regarded as a modern fundamental text on the subject " and " occupies a very high place indeed in the ranks of first-class scientific literature."

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.53 : 621.396.96 **76**

The Daylight Meteor Streams of 1947 May-August.—J. A. Clegg, V. A. Hughes & A. C. B. Lovell. (*Mon. Not. R. astr. Soc.*, 1947, Vol. 107, No. 4, pp. 369–378.) Whereas the results of 4.2-m radar observations on well-known meteor showers in the autumn and winter of 1946/1947 conformed closely to expectation from previous visual work, a similar investigation of a shower with radiant near η Aquarii, begun 1st May 1947, revealed an unexpectedly large belt of meteoric activity observable only in daylight. Some of this activity continued throughout August, 1947. This may be a recurrent phenomenon which explains the high general level of activity found by Prentice, Lovell & Banwell (2779 of 1948).

523.72.029.62 : 621.396.822 **77**

Shape of Pulses of Radio-Frequency Radiation from the Sun.—S. E. Williams. (*Nature, Lond.*, 17th July 1948, Vol. 162, No. 4107, p. 108.) Analysis of the shape of the tail of 78 single 75-Mc/s pulses shows that 58 were probably exponential in shape, 11 less probably so, 4 probably not so and 5 definitely not. Attempts to interpret the rising portion of the pulse curve in terms of exponential functions were unsuccessful.

523.746 **78**

Magnetic and Electric Phenomena in the Sun's Atmosphere associated with Sunspots.—R. G. Giovanelli. (*Mon. Not. R. astr. Soc.*, 1947, Vol. 107, No. 4, pp. 338–355.) A method is given for the determination of the magnetic and electric fields near a sunspot which is growing in either a non-conducting or a uniformly-conducting medium. The circulation of currents in the medium is critically dependent on the presence of an external magnetic field.

523.78"1945.07.09" : 551.510.535 **79**

Solar Eclipse Observations of the Ionosphere.—C. W. McLeish. (*Canad. J. Res.*, May 1948, Vol. 26, Sec. A, No. 3, pp. 137–144.) Discussion of measurements made before, during and after the eclipse of 9th July 1945 with automatic recording equipment. Analysis of the results indicates effective recombination coefficients of 1.6×10^{-8} for the E region, 1.4×10^{-8} for the F_1 region and 1.0×10^{-9} for the F_2 region. Evidence of a variable coefficient for the E region agrees with the view that at this level there is a high negative-ion density.

523.854 : 621.396.822 **80**

Galactic Noise.—R. v. d. R. Woolley. (*Mon. Not. R. astr. Soc.*, 1947, Vol. 107, No. 3, pp. 308–315.) Electron velocity temperatures of about 12 000° may be expected near early-type stars, where ionized hydrogen is the main constituent. In other regions of interstellar space, where metallic ions greatly outnumber hydrogen ions, the temperature is of the order of 1 000°. Galactic noise of the intensity reported can only come from the hot regions.

550.384 **81**

Recent Work on the Earth's Main Magnetic Field.—(*Observatory*, Aug. 1948, Vol. 68, No. 845, pp. 144–149.) Report of a discussion at the Royal Astronomical Society. See 3409 of 1948.

550.385 : 523.745 **82**

Magnetic Storms and Solar Activity, 1947.—H. W. Newton. (*Observatory*, Feb. 1948, Vol. 68, No. 842, pp. 36–37.) Review of sunspot records, magnetic variations, magnetic storms and sudden commencements for the year, with a table of 19 magnetic storms recorded at Abinger.

551.508.15 : 551.510.41 **83**

An Ozone Radiosonde.—Stranz. (*See* 169.)

551.510.535 : 523.53 **84**

Observations of Scatter Clouds.—T. L. Eckersley. (*Nature, Lond.*, 3rd July 1948, Vol. 162, No. 4105, pp. 24–25.) A large increase in scatter clouds, not associated with visible meteors, may be observed before a Dellinger fade. This effect is attributed to the large amount of ultra-violet radiation from the sun at the time of the fade. The main effects observed by Millman, McKinley & Burland (2511 of 1948) are explainable by the above, together with the author's theory of meteor evaporation and the physics of scatter clouds (91 of 1948).

551.510.535 : 525.624 : 550.384.4 **85**

Electric Conductivity of the Ionospheric D-Region.—D. F. Martyn : T. G. Cowling & R. Borger. (*Nature, Lond.*, 24th July 1948, Vol. 162, No. 4108, pp. 142–143.) Discussion on 3116 of 1948 (Cowling & Borger) and 1024 of 1948 (Martyn). Martyn considers it doubtful whether tidal motions increase with height in the ionosphere. Experimental evidence strongly suggests that the main part of the magnetic variations is produced below the E region, but this must somehow be reconciled with the relatively small theoretical conductivity likely to be found there.

Cowling & Borger emphasize that work on atmospheric tidal motions is still only exploratory, and do not think that Hall currents can set up polarization capable of counteracting the magnetic reduction in E-layer conductivity.

551.510.535 : 551.543 **86**

A Note on a New Ionospheric-Meteorological Correlation.—T. G. Mihran. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1948, Vol. 36, No. 9, pp. 1093–1095.) A new correlation is suggested between the time of occurrence of the maximum F_2-layer critical frequency during a single day and the mean value of ground-level barometric pressure for that day.

551.510.535 : 621.396.11 **87**

Measurements of the Interaction of Radio Waves in the Ionosphere.—Huxley, Foster & Newton. (*See* 194.)

551.510.535 : 621.396.11.029.58 **88**

The Importance of Ionosphere Conditions for Long-Distance Radio Communication.—H. J. Groenewold. (*Tijdschr. ned. Radiogenoot.*, July 1948, Vol. 13, No. 4, pp. 103–129. Discussion, 2 pp.) A review of present knowledge of the role of the ionosphere in s.w. propagation.

551.510.535 : 621.396.96 : 523.53 **89**

A Study of Transient Radar Echoes from the Ionosphere.—E. Eastwood & K. A. Mercer. (*Proc. phys. Soc.*, 1st Aug. 1948, Vol. 61, No. 344, pp. 122–134.) Experiments performed between January 1945 and July 1946 in the frequency range 20–40 Mc/s support the meteoric theory of burst formation. The small amount of solar influence is explained in terms of E-region ionization ; the sun does not appear to emit radiation capable of causing bursts. Analysis of the observations suggests that the greater proportion of the bursts is created within a thin layer located at a height of 86 km ; the distribution of the bursts within this layer has proved to be uniform over wide areas and no latitude effect has been detected. It is established that the rate of incidence of bursts which present echoing areas between A and $A + dA$ m² to a radio wave of frequency ν may be expressed in the form $CdA/\nu^3A^{3/2}$, with C constant.

551.594.221 **90**

The Mechanism of Lightning Discharge.—L. B. Loeb. (*J. Franklin Inst.*, Aug. 1948, Vol. 246, No. 2, pp. 123–148.) A survey of recent researches and modern theories.

LOCATION AND AIDS TO NAVIGATION

621.396.93 **91**

The Influence of the Human Element in Direction Finding.—J. D. Peat. (*Marconi Rev.*, July/Sept. 1948, Vol. 11, No. 90, pp. 69–77.) Discussion of the accuracy of d.f. bearing observations in the 1–20-Mc/s band and of a method of eliminating human errors by means of a recording device. Results obtained by visual, aural and recorded observations on typical transmissions are compared statistically.

621.396.93 : 621.396.821 : 551.594.6 **92**

Extension, to Radiogoniometers for Atmospherics, of the Definition of the Operation Threshold in terms of a Pulse Flux.—F. Carbenay. (*C. R. Acad. Sci., Paris*, 2nd Aug. 1948, Vol. 227, No. 5, pp. 337–339.) See also 2902 and 3504 of 1948.

621.396.932 **93**

A Survey of the Problems Involved in the Provision of Radio Aids to Marine Navigation.—P. G. Redgment. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 1012–1015.) Discussion of the operating frequency, type of presentation and other special factors in the design of aids required in pilotage waters, in coastal navigation, in making a land-fall or in navigation in mid-ocean. A plea is made for the design of an associated group of systems employing, if possible, a common principle and requiring as few different sets of shipboard equipment as possible. (*Note.* For international recommendations on marine radar see 3135 of 1947 and 112 of 1948.)

621.396.932 **94**

New Developments in Marine Radio Direction Finders.—H. Busignies. (*Elect. Commun.*, June 1948, Vol. 25, No. 2, pp. 196–203.) A general review presented at the International Merchant Marine Radio Aids to Navigation Conference, New London, Conn., 1947. Suggestions for improvement include : (*a*) use of other wavelengths, (*b*) use of pulse transmissions, (*c*) direct-reading indication of bearings, (*d*) combination of distance measurement and bearing.

621.396.932 **95**

A Time-Multiplex Radio-Frequency Phase-Comparison Method for Navigational Systems.—H. T. Mitchell & T. Kilvington. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 977–983 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 267.) Discussion of the Post Office Position Indicator (P.O.P.I.) hyperbolic navigation system, designed to assist ships in conditions of poor visibility. The c.w. signals whose phases are to be compared are radiated on a common frequency at intervals and in sequence from the various aerials comprising the system. Some practical results are given for an experimental arrangement using aerials $\lambda/2$ apart, but the system is inherently capable of being used with wide aerial spacings.

621.396.933 **96**

Note on a Short-Range Radio Position-Finding System using Modulated Continuous Waves.—R. F. Cleaver. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 984–989 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 267.) The range of an aircraft is found by comparing the phases of the modulation envelopes of signals (*a*) transmitted from and (*b*) received at a ground station after re-transmission from the aircraft on a different carrier frequency. By combining apparatus for such phase comparison with a v.h.f. automatic direction finder and conventional communication equipment, the range and azimuth of the aircraft are displayed on a c.r.o. without ambiguity for distances up to 100 miles. Range accuracy is within about 1 mile.

621.396.933 : 629.13.052 **97**

Low-Reading Absolute Altimeters.—B. A. Sharpe. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 1001–1011 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 268.) General considerations affecting design and performance of f.m. radio altimeters are discussed and existing instruments operating at 400 Mc/s as well as projected designs for 1 600 Mc/s are described. At present, with suitable well-placed aerials, satisfactory operation is possible at altitudes from zero to about 5 000 ft.

621.396.933 : 629.139.83 **98**

C.W. Radio Aids to Approach and Landing.—M. Birchall. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 943–952 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 267.) Discussion of the fundamental problems involved. The display of the intelligence provided is of primary importance. ' Crossed-pointer ' meter presentation giving elevation and azimuth on one instrument is preferred. Existing c.w. radio systems are described, the general principle of operation being the use of partially overlapping radio beams to define a particular direction in space. The most serious technical objection to existing m-λ or dm-λ systems is the distortion of the radio beams by reflections. Future trends are likely to be towards the use of highly directive cm-λ systems, to overcome siting troubles.

621.396.933.2 **99**

C.W. Radio Aids to Homing and Blind Approach of Naval Aircraft.—D. Quinn & R. D. Holland. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 953–960 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 267.) Description of beacons at present in use in aircraft carriers and at naval air stations. These include rotating aerial beacons and those having overlapping aerial patterns. The problems peculiar to naval applications are discussed.

621.396.933.2 **100**

The Omni-Directional Radial-Track Guide.—J. H. Ashton & A. N. Beresford. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 990–1000.) Essentially a rotating radio beacon with a cardioid type of polar diagram. When the rotation takes place at high speed, the bearing of the receiving station is given by the phase of the a.m. envelope of the received waves. Two-aerial rotating systems and four-aerial fixed systems with mechanical or electronic modulators are described. Accuracy is limited by re-radiation and by polarization errors.

621.396.933.2 : 621.317.79 **101**

The Development of Monitoring and Remote-Control Equipment for Radio Aids to Naval Flying.—Quinn & LePage. (*See* 159.)

621.396.933.23 **102**

Indication of Landing Courses Independent of Weather Conditions.—K. F. Niessen. (*Philips Res. Rep.*, Feb. 1948, Vol. 3, No. 1, pp. 1–12.) The landing course is determined as the intersection of a vertical plane F_1 with the surface of a cone whose axis lies in F_1. See also 1769 of 1946.

621.396.933.24 **103**

The Consol Navigation System.—A. H. Brown. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 968–976 ; summary, *ibid.*, Part IIIA, Vol. 94, No. 11, p. 267.) The principles of operation and the general arrangement and design of the equipment are described. Theoretical and operational range and accuracy characteristics are given. See also 2252 of 1948 (Jessell) and 2912 of 1946 (Clegg).

621.396.96 **104**

Theoretical and Practical Radar Problems.—E. Istvánffy. (*Elektrotechnika, Budapest*, Aug. 1948, Vol. 40, No. 8, pp. 167–181.) A review of modern developments.

621.396.96 : 526.9 **105**

The Use of Radar in Surveying.—(*See* 188.)

621.396.933 **106**

Loran : Long Range Navigation. [Book Review]—J. A. Pierce, A. A. McKenzie & R. H. Woodward (Eds). McGraw-Hill, New York, 1948, 467 pp., $6. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1948, Vol. 36, No. 9, p. 1141.) Volume 4 of the Radiation Laboratory series. A description of the loran system, the history of its development, and the associated equipment. For another review see *Nature, Lond.*, 23rd Oct. 1948, Vol. 162, No. 4121, pp. 633–635.

MATERIALS AND SUBSIDIARY TECHNIQUES

534.845 **107**

Behavior of Acoustic Materials.—Cook. (*See* 7.)

535.37 **108**

Excitation Time of Silver-Activated Zinc Sulfide on Electron Bombardment.—J. F. Mullaney, F. Reines & H. G. Weiss. (*Phys. Rev.*, 15th Aug. 1948, Vol. 74, No. 4, pp. 491–492.) The rise time of visible radiation was found to be $< 10^{-8}$ sec, the limit of the measurement technique.

535.37 **109**

Electrical Properties of Incomplete Phosphors.—R. Frerichs. (*Research, Lond.*, Feb. 1948, Vol. 1, No. 5, pp. 208–211.) An account of measurements on large single crystals of CdS grown by the reaction of Cd vapour and H_2S at high temperature.

535.37 **110**

The New Phenomena of Electrophotoluminescence and its Possibilities for the Investigation of Crystal Lattice.—G. Destriau. (*Phil. Mag.*, Oct.–Dec. 1947, Vol. 38, Nos. 285–287, pp. 700–739, 774–793 & 880–888.) A 4-part theoretical and experimental study of the phenomena presented by photoluminescent compounds submitted to the action of intense electric fields. Part 1 : Discussion of the excitation of luminescence in certain substances by varying electric fields of high intensity. The preparation of the substances and of the cells in which they were examined is also described. Part 2 : Results of a study of the momentary illumination produced by the action of an electric field in phosphorescent sulphides which have been previously stimulated. Part 3 : Discussion of the extinction of visible phosphorescence by electric fields. Part 4 : Discussion of the electrical acceleration of infra-red extinction.

549.514.51 **111**

The Development of Quartz Crystal Production.—C. F. Booth & J. P. Johns. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 899–911. Bibliography, pp. 910–911. Summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 243.) The specifications and production techniques for bulk-produced BT-cut shear-mode crystals in the frequency range above 3 Mc/s are described. Details are given of machine processes, the solving of the activity-aging problem and the examination for raw-material faults. The reconditioning of crystal units and future developments are also considered.

549.514.51 **112**

The Control and Elimination of Electrical (Dauphiné) Twinning in Quartz.—W. A. Wooster, N. Wooster, J. L. Rycroft & L. A. Thomas. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 927–938 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 243.) Experimental methods use heat treatment while the quartz plate is subjected to stresses applied by either temperature gradients, pure bending, longitudinal compression or torque. 'Piezocrescence' and the effect of crystallographic orientation are discussed. Practical application of the methods to crystals of various cuts used in telecommunication apparatus removed twinning in 60–70% of the plates submitted.

621.3.032.53 : 533.5 **113**

Stresses in Two-Wire Glass-to-Metal Seals.—O. Adams. (*J. Soc. Glass Tech.*, April 1948, Vol. 32, No. 145, pp. 99–112.) A brief discussion of the behaviour of glass in plane stress when examined in plane polarized light is followed by a description of the estimation, by Filon's graphical integration method, of the principal stresses in flat two-wire glass-to-metal seals.

621.315.332 : 535.827.2 **114**

The Microscopic Examination of Enamelled Wire.—J. H. Wredden. (*J. R. micr. Soc.*, 1946, Vol. 66, pp. 9–22.) Shortage of china-wood oil supplies during the war stimulated the development of synthetic resins as a substitute covering for coil wire. Four kinds of substitute covering were therefore tested : (*a*) standard enamel, (*b*) a polyvinyl-acetal covering, (*c*) nylon, and (*d*) a double covering consisting of an inner layer of standard enamel and an outer layer of nylon. Enlarged photographs show the effect of phenol on each of the coverings : nylon is superior to the others, but even its resistance to phenol is low. Enlarged photographs also show these coverings (*a*) as normally received, (*b*) after a 10% elongation by stretching, (*c*) at the point of fracture brought about by a steady pull along the sample, (*d*) after bending the wire round its own diameter without previous stretching, and (*e*) after heating in an oven to 150°C for 4 hours, followed by treatment (*d*). Results of these tests are discussed and experimental methods and apparatus are briefly described.

621.315.59 **115**

The Variation with Vapour Pressure of the Properties of Certain Electronic Semi-Conductors.—C. A. Hogarth. (*Phil. Mag.*, April 1948, Vol. 39, No. 291, pp. 260–267.) Formulae are given, and compared with experimental results, for the variation with vapour pressure of the Hall effect and thermoelectric power of semiconductors having an ionic lattice structure.

621.315.591.5† **116**

Thermo-Electric and Conductive Properties of Blue Titanium Dioxide.—H. K. Henisch. (*Elect. Commun.*, June 1948, Vol. 25, No. 2, pp. 163–176. Bibliography, p. 177.) Measurements were made on several samples of sintered TiO_2 over a wide range of temperatures. The results agree with expressions developed from a simple theory of thermoelectric effects, based on the electronic energy relations at a metal/semiconductor contact.

621.315.61 **117**

Some Modern Developments in Electrical Insulation.—R. Snadow. (*Engineer, Lond.*, 13th Aug. 1948, Vol. 186, No. 4829, pp. 170–171.) A short review dealing with thermosetting varnishes, flexible enamels, improved types of fabric board, and silicone varnishes.

621.315.61.011.5.029.63 **118**

Dielectric Constants of Some Solid Insulating Materials at Ultra Short Waves.—S. K. Chatterjee & Rajeswari. (*Indian J. Phys.*, April 1948, Vol. 22, No. 4, pp. 180–188.) Measurements by a standing-wave method for λ 57.7–140 cm show that the dielectric constant of paraffin wax increases slightly with decreasing wavelength. Mica, plexiglass, ebonite and other materials tested show the reverse effect.

621.315.61.011.5.029.63 **119**

Dielectric Properties of Some Solid Insulating Materials at 750 Mc/s.—S. K. Chatterjee. (*Indian J. Phys.*, April 1948, Vol. 22, No. 4, pp. 157–166.) A resonant-line method was used to measure the dielectric constant and power factor of mica, mycalex, plexiglass and ebonite. Plexiglass was found to have the lowest loss factor.

621.315.616 **120**

Review of the Principal New Synthetic Insulating Materials.—R. Leprêtre. (*Rev. gén. Élect.*, Sept. 1948, Vol. 57, No. 9, pp. 356–360.) General discussion, with a table giving the mechanical and electrical properties of hard plastics, rubbers and silicones.

621.318.32 : 621.317.44 **121**

Study of Metals by Hertzian Waves with the Help of Permeameters with Demountable Coils.—Épelboim. (*See* 147.)

621.318.323.2.042.15 : 621.775.7 **122**

Nickel-Iron Alloy Dust Cores.—S. E. Buckley. (*Elect. Commun.*, June 1948, Vol. 25, No. 2, pp. 126–131.) A paper read at the symposium on powder metallurgy noted in 150 and 451 of 1948. High and constant permeability and low core losses are the most important requirements for telecommunications equipment.

621.775.7 : 061.3 **123**

Powder Metallurgy.—(*Metal Ind., Lond.*, 6th & 13th Aug. 1948, Vol. 73, Nos. 6 & 7, pp. 103–105 & 129–130.) A report of the proceedings at the first international symposium on powder metallurgy at Graz, July 1948, at which more than 70 papers, covering all aspects of the theory and technology of the subject, were read.

669.018.5 **124**

New Alloy has Improved Electrical Resistance Properties.—(*Materials & Methods*, Aug. 1948, Vol. 28, No. 2, pp. 62–63.) 'Evanohm' (75% Ni, 20% Cr, 2.5% Al, 2.5% Cu) has a much higher specific resistance and tensile strength and a slightly lower temperature coefficient of resistance and coefficient of thermal expansion than existing alloys such as manganin and constantan.

669.71 : 620.197.2 **125**

Aluminium Protection.—(*Metal Ind., Lond.*, 1st Oct. 1948, Vol. 73, No. 14, p. 265.) A method developed by the Société de Produits Chimiques des Terres Rares involves the use of a solution known as Framanol. This consists of (*a*) Cr compounds, (*b*) phosphoric acid, (*c*) alcohol and (*d*) triethanolamine. (*c*) and (*d*) remove grease, (*b*) and (*d*) dissolve the surface layer of oxide, and a light deposit of Cr oxide from (*a*) renders the cleaned surface inert.

535.37 **126**

Preparation and Characteristics of Solid Luminescent Materials. [Book Review]—G. R. Fonda & F. Seitz (Eds). J. Wiley & Sons, New York and London, 1948, 459 pp., $5.00. (*Amer. J. Sci.*, Sept. 1948, Vol. 246, No. 9, pp. 595–596.) ". . . for the most part a series of papers presented at a conference at Cornell University held by the Division of Electron Physics, American Physical Society, in October of 1946. These have been edited and supplemented with introductory and background material."

MATHEMATICS

512.9 **127**

Gabriel Kron on Tensor Analysis.—S. A. Stigant. (*Beama J.*, Aug. 1948, Vol. 55, No. 134, pp. 276–284.) An up-to-date record of Kron's published work on the theories and applications of tensor analysis in engineering, mechanics, hydrodynamics and physics, revealing the exceptional versatility of the methods he has pioneered. A complete list is appended of Kron's books and papers, in chronological order, with names and addresses of publishers.

518.5 **128**

Calculating Machines.—(*Nature, Lond.*, 8th May 1948, Vol. 161, No. 4097, pp. 712–713.) A short account of a discussion, sponsored by the Royal Society, on automatic digital computing machines. General descriptions are given of the machines either completed or under development in the United States (relay and electronic), the University of Cambridge, and the National Physical Laboratory (electronic, with mercury delay lines for storage), the University of Manchester (c.r. tube storage devices), and Birkbeck College (electronic, with parallel operation).

518.5 **129**

Modern Mathematical Machines : Part 1—The Bush-Caldwell Differential Analyser.—M. Berry. (*Tech. mod., Paris*, 1st/15th Aug. 1948, Vol. 40, Nos. 15/16, pp. 246–251.) An account of the mechanization of the different operations and of the method of use, with a short description of actual equipment. Part 2, 130 below.

518.5 **130**

Modern Mathematical Machines : Part 2.—M. Berry. (*Tech. mod., Paris*, 1st/15th Sept. 1948, Vol. 40, Nos. 17/18, pp. 283–287.) Discussion of the characteristics of 'universal' machines, with a short description of the Eniac. An outline is given of the chief features of a machine for the Centre national de la Recherche scientifique. This should be completed within a year and will be much more flexible in use than the Eniac. Part 1, 129 above.

518.5 : 512.831 **131**

An Electrical Network for Determining the Eigenvalues and Eigenvectors of a Real Symmetric Matrix.—A. Many & S. Meiboom. (*Rev. sci. Instrum.*, Nov. 1947, Vol. 18, No. 11, pp. 831–836.) A network for the solution of a matrix of order n consists of n LC circuits, each coupled to each of the others through two capacitors, which are adjusted according to the elements of the matrix. The solution is derived from observation of resonant frequencies and voltages when the network is excited from a variable-frequency source. The theory includes a discussion of the accuracy attainable. Solution for a fifth-order matrix takes about 4 hours. An instrument for solving matrices up to the tenth order is planned. See also 3562 of 1947 (Hughes & Wilson).

MEASUREMENTS AND TEST GEAR

53.087 **132**

A Distribution Analyzer for Lengths of Impulses.—O. R. Garfield. (*Bell Lab. Rec.*, Aug. 1948, Vol. 26, No. 8, pp. 325–330.) Records the number of pulses longer than each of 10 given times, on 10 groups of message registers and neon lamps marked from 0 to 9. The zero register records the pulses longer than 50 μs, while register n records those longer than nt, where t is adjustable in multiples of 2 from 1.56 ms to 12.8 sec.

531.761 : 621.317.755 **133**

A Spiral Chronograph for Long Time Intervals.—H. D. Warshaw. (*Rev. sci. Instrum.*, July 1948, Vol. 19, No. 7, pp. 420–423.) A chronograph differing basically from those of Emrich (3569 of 1947) and Moran (764 of 1948). It measures times up to 12 ms and develops a logarithmic spiral by means of a circuit which has no modulating network. Time markers on the spiral every 10 μs or 20 μs are derived from a crystal-controlled oscillator. The sweep speed of the trace is 1 revolution in 2 ms.

621.3.018.4 (083.74) **134**

[British] **Standard Frequency Transmissions.**—(*Wireless World*, Sept. 1948, Vol. 54, No. 9, p. 322.) The daily schedule of experimental low-power transmissions from station GMT at Abinger, Surrey, is :

0958–1000 G.M.T., announcement of call sign.
1000–1015, radiation of unmodulated 2-Mc/s carrier.
1015–1025, radiation of carrier with 1 000-c/s modulation.
1025, announcement of provisional frequency correction.

Corrections are accurate to within about 2 parts in 10^8.

Arrangements are under consideration for a limited standard-frequency service, on three frequencies, to be operated by the General Post Office. Details will be given later. Meanwhile, an accuracy within 1 part in 10^6 is given by all B.B.C. medium-wave transmissions, except that on 583 kc/s, and by those from GBR Rugby on 16 kc/s, Droitwich on 200 kc/s, GRO Skelton on 6 180 kc/s and GSV Daventry on 17 810 kc/s.

621.3.018.4(083.74) : 621.396.81 **135**

Reception at Turin of the Standard Signals of the National Bureau of Standards, Washington.—C. Egidi & G. Gregoretti. (*Alta Frequenza*, Aug. 1948, Vol. 17, No. 4, pp. 161–167. In Italian, with English, French and German summaries.) Systematic reception tests for the reception of WWV 10-Mc/s and 15-Mc/s signals, from July 1946 to June 1947, show that the 10-Mc/s signals can nearly always be received satisfactorily at Turin.

621.316.726.078.3 **136**

Frequency Stabilization in the Region of 10 000 Mc/s.—A. V. Donnelly. (*Communications*, July 1948, Vol. 28, No. 7, pp. 6–8, 31.) Frequencies in the microwave region can be stabilized (*a*) by reference to a frequency obtained from a quartz oscillator by successive multiplication, or (*b*) by a feedback system of automatic frequency control incorporating a cavity as the reference standard. Method (*a*) is more accurate and method (*b*) more convenient.

621.317.3 : 621.396.611.21 **137**

Precision Measurement of Electrical Characteristics of Quartz-Crystal Units.—W. D. George, M. C. Selby & R. Scolnik. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1948, Vol. 36, No. 9, pp. 1122–1131.) Discussion of : (*a*) the equivalent circuit of such units, (*b*) measurement methods and techniques in which a generator of continuously adjustable frequency and of stability comparable with that of a crystal unit is combined with a r.f. bridge or a *Q*-meter, and (*c*) measurement of secondary responses. Graphs show the difference between a 'normal' crystal and one remaining constant under limited conditions. Data based on fundamental crystal-unit characteristics are correlated with data derived from the behaviour of the unit in a particular oscillator.

621.317.3 : 621.397.61 **138**

TV Transmitter Design : Part 4.—G. E. Hamilton. (*Communications*, Aug. 1948, Vol. 28, No. 8, pp. 8–9..33.) Discussion of techniques for measuring (*a*) transmitting power output by a calorimeter method, (*b*) transmitter regulation and output variation, (*c*) frequency response, and (*d*) transient response. For previous parts see 2948 and 3532 of 1948.

621.317.332 **139**

On the Limits of Absolute Accuracy for Resistance Measurements at High Frequencies.—H. H. Meinke. (*Arch. elekt. Übertragung*, Sept./Oct. 1947, Vol. 1, Nos. 3/4, pp. 101–107.) Discussion of methods involving measurements of nodal distances and voltage maxima and minima along a transmission line of known characteristic impedance. Methods of reducing possible errors are described.

621.317.333 **140**

A Statistical Method for Determining the Breakdown Voltage of a Dielectric.—A. S. Zingerman. (*Zh. tekh. Fiz.*, Aug. 1948, Vol. 18, No. 8, pp. 1029–1043. In Russian.)

621.317.333.4 : 621.396.615.17 **141**

Measurement of Phenomena of Extremely Short Duration.—W. Kroebel. (*Arch. elekt. Übertragung*, Sept./Oct. 1947, Vol. 1, Nos. 3/4, pp. 108–113.) A pulse generator is described which uses gas-discharge valves, gives considerable power and can be applied for short-time measurements of high accuracy. Its use is considered for the location of faults in a cable for which the propagation velocity of electric waves is known.

621.317.336 : 621.315.212 **142**

Study of the Impedance Irregularities of Coaxial Cables by Oscillographic Observation of Pulse Echoes.—G. Couanault & P. Herreng. (*Câbles & Transmission, Paris*, April & July 1948, Vol. 2, Nos. 2 & 3, pp. 111–130 & 219–232. With English summary.) The pulses used have sensibly rectangular shape, duration 0.1 or 0.2 μs and recurrence frequency 50 000 per sec. The echoes arising from cable irregularities, after amplification, are displayed on a c.r.o. Lengths of cable up to 560 m can be tested by equipment developed by the Société Alsacienne de Constructions Mécaniques ; a detailed description of this echo meter is given.

621.317.336 : 621.396.67 **143**

Television Receiving Aerials : Impedance Measuring and Matching Methods.—Bell. (*See* 18.)

621.317.4 : 538.221 **144**

The Measurement of Permeability and Magnetic Losses of Non-Conducting Ferromagnetic Material at High Frequencies.—H. J. Lindenhovius & J. C. van der Breggen. (*Philips Res. Rep.*, Feb. 1948, Vol. 3, No. 1, pp. 37–45.) A ring made of the material to be tested and a ring of the same size made of a conducting metal are successively inserted, concentrically with the inner conductor, into a coaxial cavity resonator with end capacitance. The susceptibility of the ferromagnetic material equals the ratio of the two changes in resonant frequency, and the losses can be computed from the bandwidths of the cavity resonator with and without the ferromagnetic ring. This method has been used between 30 and 300 Mc/s. Above 300 Mc/s a coaxial Lecher system is substituted for the cavity resonator.

621.317.41 **145**

High-Frequency Permeameter.—M. Cogniat. (*Câbles & Transmission, Paris*, July 1948, Vol. 2, No. 3, pp. 195–207. With English summary.) An instrument for rapid measurements on thin tape or stampings at frequencies from 50 kc/s to 1.6 Mc/s. The value of the permeability is found from the detuning of an LC circuit caused by insertion of the sample into the inductor. Full construction details are given, with all coil data.

621.317.44 : 538.23 **146**

Cathode-Ray Magnetization-Curve Tracer.—M. V. Scherb. (*Rev. sci. Instrum.*, July 1948, Vol. 19, No. 7, pp. 411–419.) An instrument which displays, upon a direct-reading c.r. tube screen, the hysteresis loop of the test specimen, whose cross-section may range from 10^{-5} cm^2 to 0.3 cm^2 ($\frac{1}{4}$-inch rod). Full circuit details and operation procedure are given. With slight modifications, the apparatus can be used for other types of magnetic measurement.

621.317.44 : 621.318.32 **147**

Study of Metals by Hertzian Waves with the Help of Permeameters with Demountable Coils.—I. Épelboim. (*Onde élect.*, Aug./Sept. 1948, Vol. 28, No. 257, pp. 322–327.) Description of permeameters similar in principle to the apparatus considered in 797 of 1947, and of industrial instruments for the routine testing of annular iron-dust cores at frequencies up to 60 Mc/s. Results of measurements on magnetic powders dispersed in rubber show that for samples in which the volume of the powder does not exceed that of the dielectric, the magnetization is proportional to the logarithm of the permeability. With transformer stampings the relaxation effect is found at km λ while in the case of iron powders dispersed in rubber it is only observed at cm λ.

621.317.6.029.3 : 621.317.755 **148**

An Automatic Audio Frequency Response Curve Tracer : Parts 1 & 2.—G. L. Hamburger. (*J. Brit. Instn Radio Engrs*, July/Aug. 1948, Vol. 8, No. 4, pp. 154–168.) Description, with full details of the various units, of equipment for displaying on the screen of a c.r. tube the a.f. response curve of any type of network. Logarithmic scales are used for both frequency (39 c/s to 10 kc/s) and amplitude (−21 db to + 18 db). After completing the response curve for a tone of constant voltage swept from 11 kc/s down to 39 c/s in one or two seconds, the tone is switched off automatically and a calibration raster, in octaves and 3-db steps, appears. With a long-afterglow screen, both raster and response curve can be seen together. Part 1 was reprinted in *Proc. Instn Radio Engrs, Aust.*, Oct. 1947, Vol. 8, No. 10, pp. 16–19.

621.317.725 **149**

A Precision High-Voltage Vacuum-Tube Voltmeter.—L. C. L. Yuan. (*Rev. sci. Instrum.*, July 1948, Vol. 19, No. 7, pp. 450–452.) Range, 0–5 000 V. Input impedance $> 5 \times 10^4$ MΩ. Linear characteristic. Accuracy within 0.05%.

621.317.725 : 621.394/.396].44 **150**

Tuned Valve-Voltmeter in Carrier-Frequency Technique.—W. Klein. (*Funk u. Ton*, Sept. 1948, Vol. 2, No. 9, pp. 466–468.) Ordinary valve voltmeters are independent of frequency over a fairly wide range, but for carrier-current systems a tuned voltmeter is a decided advantage, as it can be used for measurements in one channel without interfering with communication in the other channels of a multiplex system. Suitable designs are given for direct and for heterodyne types of meter, with block diagrams.

621.317.726 **151**

An Improved Peak Voltmeter for Pulses.—Y. P. Yu. (*Rev. sci. Instrum.*, July 1948, Vol. 19, No. 7, pp. 447–450.) Comprises a gate generator, an electronic switch, a capacitor, a bridge-balanced cathode follower of very high input resistance, and a d.c. voltmeter. Accuracy is within 4.5% for pulse widths from 0.5 μs to 50 ms and repetition frequencies from 10 to 200 000 pulses per sec.

621.317.733 : 621.317.715 **152**

Location of the Galvanometer Branch for Maximum Sensitivity of the Wheatstone Bridge.—F. R. Kotter. (*Bur. Stand. J. Res.*, May 1948, Vol. 40, No. 5, pp. 401–404.) The battery and galvanometer connections to the bridge may be interchanged without altering the condition for balance, but one of the combinations will give higher sensitivity. A rule-of-thumb method is given for determining the more sensitive arrangement. Only the bridge arm resistances and the external critical damping resistance of the galvanometer need be known.

621.317.734 **153**

Electronic Megohmmeters.—H. G. M. Spratt. (*Wireless World*, Oct. 1948, Vol. 54, No. 10, pp. 354–357.) A method of measuring resistances up to about 10^{12} Ω, depending upon the exponential grid-voltage/grid-current characteristic of the normal triode.

621.317.755 **154**

The Principles and Practice of Panoramic Display.—D. W. Thomasson. (*J. Brit. Instn Radio Engrs*, July/Aug. 1948, Vol. 8, No. 4, pp. 171–186. Discussion, pp. 186–189.) The technique of the production of c.r.o. displays with one scale a frequency scale, either linear or logarithmic, is reviewed theoretically and practically. The limitations of the apparatus used are discussed and various practical design problems are considered.

621.317.755 : 621.397.62.001.4 **155**

An Electronic Wobbulator for Television.—(*Télévis. franç.*, July/Aug. 1948, No. 39, pp. 11–15.) Details of an instrument permitting direct observation on a c.r.o. of (*a*) the h.f. or m.f. selectivity curve for a receiver, after detection or after the video amplifier, (*b*) the pass-band curve at the output of the video amplifier, (*c*) image and synchronization signals. An instrument of this type has been in constant use for more than a year for receiver production testing.

621.317.761 **156**

A Direct Reading Frequency Measuring Set.—F. C. F. Phillips. (*J. Brit. Instn Radio Engrs*, Jan./Feb. 1948, Vol. 8, No. 1, pp. 4–15. Discussion, p.16.) The equipment consists of a series of decade stages terminating in a deflection type of frequency meter. The signal of unknown frequency is heterodyned successively with each of the decade stages, whose settings give the various digits of the frequency, the final figures (below 1 000 c/s) being read on the scale of the frequency meter. Circuit details are discussed and also the methods adopted to avoid any ambiguity so that the equipment can be used by relatively unskilled operators. The frequency range up to 10 Mc/s can be extended by the use of harmonics of an auxiliary oscillator.

621.317.79 : 621.396.615 **157**

Variable Frequency Standard Signal Generator.—R. G. Stokes. (*Tele-Tech*, Sept. 1948, Vol. 7, No. 9, pp. 44–47.) An equipment designed to provide any frequency between 15 kc/s and 10 Mc/s for measuring the characteristics of piezoelectric crystals. The signal is within 1 c/s of the primary standard frequency throughout the frequency range. The frequency can be varied by increments as small as 0.2 c/s. The circuit used is described, the basis being a primary standard input of 100 kc/s, an interpolation oscillator with a range of 20–40 kc/s and four variable filters, any specific output frequency being obtained by a suitable combination of frequencies from the separate units.

621.317.79 : 621.396.615.14 **158**

Measurement Generators for the Decimetre Waveband.—G. Megla. (*Elektrotechnik, Berlin*, July 1947, Vol. 1, No. 1, pp. 19–24.) Detailed description of various frequency-stable generators for λ 10–100 cm, with special reference to tuning and screening arrangements and to the design of capacitive and resistive types of potential dividers.

621.317.79 : 621.396.933.2 **159**

The Development of Monitoring and Remote-Control Equipment for Radio Aids to Naval Flying.—D. Quinn & L. S. LePage. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 961–967 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 268.) Systems which provide a continuous remote indication of the performance of radio aids for homing and blind approach are discussed.

621.319.4 (083.74) **160**

Absolute Capacitance Standard with a Resistive Shield.—T. Slonczewski. (*Rev. sci. Instrum.*, Nov. 1947, Vol. 18, No. 11, pp. 848–849.) The addition of a high-resistance shield to the guard ring of a parallel-plate capacitor reduces the fringe effect to a negligible value, so that the precise computation of capacitance is simplified.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.784 **161**

Piezoelectric Dynamometer for Recording Work Variations in Cutting [by machine tools].—P. Naslin. (*Rev. gén. Élect.*, Sept. 1948, Vol. 57, No. 9, pp.361–364.) Details of an instrument in which the sensitive element consists of 4 quartz plates with polarities reversed alternately. The charges developed on the faces are proportional to the applied pressure, which can either be measured on the scale of a calibrated microammeter or displayed on the screen of a c.r.o.

539.16.08 **162**

The Discharge Spread in Geiger-Müller Counters.—S. H. Liebson. (*Phys. Rev.*, 15th Sept. 1948, Vol. 74, No. 6, pp. 694–695.) Reasons are given for questioning the validity of the conclusions drawn by Corson & Wilson (168 below) from comparison of results obtained by Alder and others (2748 of 1947) and by Liebson (3982 of 1947) for self-quenching counters.

539.16.08 **163**

Discharge Spread in Geiger Counters with Methane and Methane/Argon Filling.—C. Balakrishnan, J. D. Craggs & A. A. Jaffe. (*Phys. Rev.*, 15th Aug. 1948, Vol. 74, No. 4, pp. 410–414.) See also 1103 of 1948 (Craggs & Jaffe).

539.16.08 **164**

A Note on Ethylene Self-Quenching G-M Counters.—K. H. Morganstern, C. L. Cowan & A. L. Hughes. (*Phys. Rev.*, 15th Aug. 1948, Vol. 74, No. 4, pp. 499–500.) Tests with alcohol, ether, ethylene or cyclopropane as the quenching gas show that ethylene gives long flat plateaux over a wider range of partial pressures than the other gases. Ethylene-filled counters give no multiple counts, are very stable with regard to counting rate and recover rapidly even after a discharge through them.

539.16.08 **165**

Dead-Time Reduction in Self-Quenching Counters.—P. B. Smith. (*Rev. sci. Instrum.*, July 1948, Vol. 19, No. 7, pp. 453–457.)

539.16.08 **166**

Coincidence-Counting System of High Resolution.—H. L. Schultz & R. Beringer. (*Rev. sci. Instrum.*, July 1948, Vol. 19, No. 7, pp. 424–427.)

539.16.08 **167**

High Speed Coincidence Circuit used for Multipliers.—E. Baldinger, P. Huber & K. P. Meyer. (*Rev. sci. Instrum.*, July 1948, Vol. 19, No. 7, pp. 473–474.)

539.16.08 **168**

Particle and Quantum Counters.—D. R. Corson & R. R. Wilson. (*Rev. sci. Instrum.*, April 1948, Vol. 19, No. 4, pp. 207–233.) A review of the operating mechanism and special properties of the commonly used counters.

551.508.15 : 551.510.41 **169**

An Ozone Radiosonde.—D. Stranz. (*Chalmers tekn. Högsk. Handl.*, 1948, No. 72, 49 pp. In German, with English summary.) Full account of experimental apparatus. Ozone content is deduced from the amount of ultraviolet radiation falling on a Cd photocell included in the equipment.

578.087.87 : 621.317.35 **170**

The Wave Analysis of Low Frequency Potentials of the Human Body.—W. E. Boyd : W. E. Benham. (*J. Brit. Instn Radio Engrs*, March/April 1948, Vol. 8, No. 2, pp. 73–84. Discussion, pp. 84–85.) Electronic methods reveal the existence of low-frequency potential variations, originating from the human body, in the frequency range 10–2 500 c/s. Analysis of these potentials appears to indicate that parts of this frequency range are related to the muscular contraction of the heart and that information may thus be obtained which is not given by present electrocardiograph technique.

Benham discusses Fourier analysis in connection with Boyd's work.

621.3.076.12 **171**

New Applications of Automatic Compensation.—T. Gast. (*Arch. elekt. Übertragung*, Sept./Oct. 1947, Vol. 1, Nos. 3/4, pp. 114–121.) Examples of different types of compensating apparatus are given and their principles explained. A pentode oscillator with inductive coupling between anode and grid circuits is described; this can be used for transforming mechanical into electrical quantities and is applied in the construction of a microbalance and also of an e.s. compensator.

621.316.578.1 **172**

Electronic Process Timer.—(*Engineer, Lond.*, 16th April 1948, Vol. 185, No. 4812, p. 387.) A capacitor is discharged through a resistor; the known discharge time can be varied between $\frac{1}{4}$ and 60 sec by a single potentiometer control. Accuracy is within 5%, and is independent of supply frequency variation or voltage changes of $\pm 15\%$. The negatively-charged capacitor plate is connected to the grid of a thyratron, the potential of which takes a positive drift until eventually the thyratron fires. Relays are thus actuated which end the timing cycle and reset the mechanism. For another account see *Engineering, Lond.*, 6th Aug. 1948, Vol. 166, No. 4306, p. 139.

621.317.39 : 620.17 **173**

Extensometers using Electrical Resistance.—R. Goethals. (*Rev. gén. Élect.*, Sept. 1948, Vol. 57, No. 9, pp. 375–379.) The operation principles of various types of instrument are briefly reviewed and details are given of resistance extensometers suitable for static or dynamic measurements.

621.317.755 **174**

The Principles and Practice of Panoramic Display.—Thomasson. (*See* 154.)

621.384.6 **175**

Experimental Work on Corrugated Waveguides and Associated Components for Linear Electron Accelerators.—L. B. Mullett & B. G. Loach. (*Proc. phys. Soc.*, 1st Sept. 1948, Vol. 61, No. 345, pp. 271–284.) The general problem of feeding r.f. power from a conventional rectangular waveguide is considered and several successful 'feeds' are described. A detailed account is given of work carried out on corrugated circular waveguides with continuously varying phase velocities, and on the associated 'feeds' for the 0.5-MeV and 4-MeV sections of long accelerators. Experimental results are in close agreement with the theoretical treatment of Harvie (176 below) and Walkinshaw (177 below).

621.384.6 **176**

Travelling Wave Linear Accelerators.—R. B. R.-S.-Harvie. (*Proc. phys. Soc.*, 1st Sept. 1948, Vol. 61, No. 345, pp. 255–270.) The relevant properties of accelerators of the corrugated waveguide type [see 506 of 1948 (Fry et al.)] and the factors influencing electron energies, are considered. Some numerical results are given for λ 10 cm. The problems of high-energy accelerators are discussed briefly and illustrated by calculations for a 500-MeV accelerator.

621.384.6 **177**

Theoretical Design of Linear Accelerator for Electrons.—W. Walkinshaw. (*Proc. phys. Soc.*, 1st Sept. 1948, Vol. 61, No. 345, pp. 246–254.) Theoretical analysis of the type of accelerator described by Fry et al. (506 of 1948). The dependence of the phase velocity on the frequency and on the dimensions of the corrugated waveguide is determined and found to be in close agreement with experiment. Tables have been computed for designing accelerator tubes for any frequency and r.f. power.

621.384.6 **178**

Effect of Azimuthal Inhomogeneities in the Magnetic Field of a Betatron or Synchrotron.—F. K. Goward. (*Proc. phys. Soc.*, 1st Sept. 1948, Vol. 61, No. 345, pp. 284–293.) Particular examples of the types of forced electron oscillations which may be encountered are considered quantitatively, with special emphasis on the problems of injecting an electron into an inhomogeneous field, and of extracting an electron by an applied inhomogeneity.

621.384.6 **179**

A 20-MeV Betatron.—W. Bosley, J. D. Craggs, D. H. McEwan & J. F. Smee. (*J. Instn elect. Engrs*, Part 1, Aug. 1948, Vol. 95, No. 92, pp. 352–358.) The construction is described. Tests made to measure the magnetic field and to locate the orbit position, etc., are fully discussed, and details are given of some new measurements on the out-of-phase fields at the instant of electron injection.

621.384.6 : 537.531 **180**

X-Radiation from a 20-MeV Betatron.—W. Bosley, J. D. Craggs, W. F. Nash & R. M. Payne. (*Nature, Lond.*, 26th June 1948, Vol. 161, No. 4104, pp. 1022–1023.) Preliminary results on the spectrum of the betatron's radiation obtained by study of (*a*) electron-positron pairs produced in a thin lead sheet in a Wilson chamber, and (*b*) the protons liberated in the photo-disintegration of deuterons.

621.385.38.001.8 **181**

Thyratrons and their Industrial Applications.—Martin. (*See* 257.)

621.385.833 **182**

Recent Advances in Electron Microscopy in the United Kingdom.—V. E. Cosslett. (*Research, Lond.*, April 1948, Vol. 1, No. 7, pp. 293–304.) A survey based on a paper read at the Philadelphia Conference, 12th December 1947.

621.385.833 **183**

On some Focal Properties of an Electron Optical Immersion Objective.—P. A. Einstein & L. Jacob. (*Phil. Mag.*, Jan. 1948, Vol. 39, No. 288, pp. 20–31.)

621.385.833 **184**

Adjustable Aperture for Electron Microscope, RCA Type EMU.—J. T. Quynn. (*Rev. sci. Instrum.*, July 1948, Vol. 19, No. 7, pp. 472–473.)

621.396.9 **185**

Search Apparatus for Metal.—O. Martin. (*Elektrotechnik, Berlin*, July 1947, Vol. 1, No. 1, pp. 15–18.) Description of various heterodyne methods, resonance methods with indication based on phase displacement, and mutual-induction methods.

621.396.9 : 531.561 **186**

A Radio Method of Studying the Yaw of Shells.—C. C. Gotlieb, P. E. Pashler & M. Rubinoff. (*Canad. J. Res.*, May 1948, Vol. 26, Sec. A, No. 3, pp. 167–198.) The shell fuse is replaced by a h.f. transmitter whose signals are used to determine the angular motion of the shell in flight. Theory of the method is given and experimental results are discussed.

621.396.9 : 550.837.7 **187**

Prerequisites for the Use of Radio Prospecting Methods.—V. Fritsch. (*Radio Tech., Vienna*, Sept. 1948, Vol. 24, No. 9, pp. 429–435.) A historical review, with discussion of some modern methods of investigation, including h.f. pulse technique. See also 216 and 1524 of 1947.

621.396.96 : 526.9 **188**

The Use of Radar in Surveying.—(*Observatory*, June 1948, Vol. 68, No. 844, pp. 100–104.) Short account of a discussion at the Royal Astronomical Society.

PROPAGATION OF WAVES

538.566 + 621.396.11 **189**

Radio-Wave Propagation Research in the Department of Scientific and Industrial Research during the Years 1937-46.—R. L. Smith-Rose. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 879–891. Bibliography, pp. 891–892. Summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 220.) Frequencies from about 10 kc/s to 50 000 Mc/s or more are considered. Discussion of (*a*) transmission of radio waves along the earth's surface, and the effect of the electrical properties of the ground, earth curvature, and obstacles, (*b*) the nature of the ionosphere and the manner in which radio waves are propagated through it, (*c*) the effect at u.h.f. of vertical temperature and humidity gradients in the lower atmosphere, (*d*) the electrical properties of the constituents of the atmosphere at u.h.f., (*e*) atmospheric and extraterrestrial noise, (*f*) the importance of the study of wave propagation for various applications of radio technique, and (*g*) the limitations of present knowledge.

621.396.11 : 551.510.535 **190**

The Accuracy of Sky-Wave Delay Measurements.—K. W. G. Harrod. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 893–898; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 220.) Measurements are described of the short-period fluctuations in the time of arrival of waves of frequencies between 2 and 16 Mc/s, received after reflection from the ionosphere. For vertical incidence, the fluctuations were of the order of ± 5 μs. At oblique incidence, for ranges up to 6 000 km, path-time differences of ± 10 to ± 20 μs were observed with two receiving aerials 400 m apart.

621.396.11 : 551.510.535 **191**

The Forecasting of Maximum Usable Frequencies for Radio Links.—P. Lejay. (*Onde élect.*, July & Aug./Sept. 1948, Vol. 28, Nos. 256 & 257, pp. 268–274 & 328–336.) American and British methods are described and the use of the world charts prepared by the Central Radio Propagation Laboratories and by the National Physical Laboratory is illustrated by the determination of the m.u.f. for each hour of the day for communication between Paris and Dakar. The need for more stations to carry out ionosphere research is emphasized. At present there is only one in the whole continent of Africa. See also 2887 of 1948.

621.396.11 : 551.510.535 **192**

Anomalous Effects in Ionospheric Absorption.—E. V. Appleton, W. J. G. Beynon & W. R. Piggott. (*Nature, Lond.*, 19th June 1948, Vol. 161, No. 4103, pp. 967–968.) The relations between any two of the three variables h' (equivalent height of reflection) i_0 (angle of incidence) and f (frequency) may be satisfactorily predicted when the third variable has a constant value, but there has been no corresponding success in deducing the absorptive behaviour of obliquely incident waves from that of vertically incident waves. Martyn's conception of equivalent frequency (1727 of 1935) gives values of attenuation which are too low for first-order reflections although satisfactory for those of higher order. It is suggested that when frequencies are used which only slightly exceed the oblique-incidence critical E-layer frequency, there is scattering or partial reflection of the waves by abnormal or sporadic-E ionization which produces the additional attenuation. Measurements at Hawick on transmissions from Fraserburgh to Swansea tend to support this theory: sporadic-E echoes at Hawick and abnormal attenuation at Swansea were observed together.

621.396.11 : 551.510.535 **193**

Diffraction from the Ionosphere and the Fading of Radio Waves.—J. A. Ratcliffe. (*Nature, Lond.*, 3rd July 1948, Vol. 162, No. 4105, pp. 9–11.) A theory of fading is outlined which regards a ' single ' reflected wave as the sum of contributions from a large number of scattering centres in the reflecting region, moving with velocities distributed according to a Gaussian law. The resultant signal is found to be analogous to that produced when random noise is passed through a filter with a specified band-pass characteristic, and the results of an analysis of this case are applied to the present problem. It is shown that the observed fading characteristics of radio waves on various frequencies from 4 Mc/s to 16 kc/s are in accord with the theory, the r.m.s. value of the scattering-centre velocity being of the same order of magnitude in each case. The theory accounts for the observed fact that the rate of fading is roughly proportional to the frequency of the wave and the distance of the transmitter. An extension of the theory to the case of scattering of a wave in transit through an ionospheric layer is briefly discussed. Simultaneous observations on the fading of single echoes from regions E and F should be useful in this respect. Various possible elaborations of the simple theory given are mentioned.

621.396.11 : 551.510.535 **194**

Measurements of the Interaction of Radio Waves in the Ionosphere.—L. G. H. Huxley, H. G. Foster & C. C. Newton. (*Proc. phys. Soc.*, 1st Aug. 1948, Vol. 61, No. 344, pp. 134–146.) Discussion of measurements of radio wave interaction in special test transmissions between the B.B.C. stations at Droitwich and Lisnagarvey (N. Ireland). The theoretical formula $M = M_0/[1 + (n/G\bar{\nu})^2]^{\frac{1}{2}}$ accurately describes the dependence of the interaction modulation M on the modulation frequency $n/2\pi$. The electronic collisional frequency ν at the seat of interaction is deduced from $G\nu$ and the laboratory value of G. The phase of the modulation is also discussed. The theory of wave interaction and its possible use as a tool in ionospheric research are briefly considered. See also 2897 of 1947.

621.396.11.029.45 **195**

Very-Long-Wave Phase Differences between Spaced Aerial Systems.—P. G. Redgment & D. W. Watson. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 1016–1022.) Transmissions from Varberg (Sweden) and Tuckerton (U.S.A.) on frequencies in the neighbourhood of 18 kc/s were received in London and Birmingham (163 km apart) and the phases compared. For the shorter distance a distinct diurnal variation in the phase difference was observed, together with slow random fluctuations which were greater at night. At the longer distance, the diurnal variation was present during the summer but was not detectable in winter. Random fluctuations of a similar order of magnitude to those at the shorter range were observed. It is concluded that a navigational aid using similar frequencies could be constructed having an equivalent-bearing accuracy within 0.2° near the median line.

621.396.11.029.58 : 551.510.535 **196**

The Importance of Ionosphere Conditions for Long-Distance Radio Communication.—Groenewold. (*See* 88.)

RECEPTION

621.396.621 + 621.396.69 **197**

New Methods of Manufacturing Radio Circuits.—J. A. Sargrove. (*Onde élect.*, Aug./Sept. 1948, Vol. 28, No. 257, pp. 299–307.) Printed-circuit technique described in 1913 of 1947.

621.396.621 **198**

The Cathode-Coupled Clipper Circuit.—L. A. Goldmuntz & H. L. Krauss. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1948, Vol. 36, No. 9, pp. 1172–1177.) Advantages of such a circuit over conventional pentode and diode types are discussed. The proper operating conditions to give the required size of output pulse, range of input voltages, valve bias for symmetrical clipping, etc., are determined analytically. Regenerative feedback considerably improves the clipping action. Design methods are outlined.

621.396.621 : 621.396.619.13 **199**

Is Discriminator Alignment So Difficult?—A. G. Crocker. (*Wireless World*, Sept. 1948, Vol. 54, No. 9, pp. 312–316.) Discussion of methods of alignment and the effects of mis-alignment. In particular the procedure suggested by Sturley (2183 of 1944) is criticized. Provided that the discriminator is suitably designed, serious alignment difficulties need not be expected.

621.396.621 : 621.396.662.3 **200**

Crystal Filters for Radio Receivers.—C. F. Floyd & R. L. Corke. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 915–926 ; summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 243.) Discussion of: (*a*) a pair of single-section bridged-T filters for Army communications receivers Types R206 and R201, (*b*) channel and carrier filters recently designed for the British Post Office two-channel single-sideband receiver, (*c*) Foster's theorem for two-terminal reactance networks and its use to determine the properties and elements of lattice networks, (*d*) resistance compensation, (*e*) the application of the equivalent circuit of a crystal resonator to filter networks and methods of calculating L and C values, (*f*) the properties of certain quartz cuts, and (*g*) the design of a new type of two-section half-lattice channel filter.

621.396.621 : 621.396.933 **201**

Very-High-Frequency Single-Channel Receiver.—W. C. Lane & T. C. Clark. (*Elect. Commun.*, June 1948, Vol. 25, No. 2, pp. 132–138.) A crystal-controlled ground-station superheterodyne receiver with high rejection of unwanted signals and good sensitivity, for use at major airports. The frequency range is 118–136 Mc/s.

621.396.821 : 621.396.93 : 551.594.6 **202**

Extension, to Radiogoniometers for Atmospherics, of the Definition of the Operation Threshold in terms of a Pulse Flux.—F. Carbenay. (*C. R. Acad. Sci., Paris*, 2nd Aug. 1948, Vol. 227, No. 5, pp. 337–339.) See also 2902 and 3504 of 1948.

621.396.822 : 621.396.619.13 **203**

Theory of Frequency-Modulated Noise.—F. L. H. M. Stumpers. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1948, Vol. 36, No. 9, pp. 1081–1092.) The energy spectrum of f.m. noise is computed for different signal/noise ratios. Numerical values are given for some simple filter amplitude characteristics. The theory is based on the Fourier concept of noise ; conditions of no signal, and of signal without and with modulation are successively considered. The result is given in the form of a convergent series. The suppression of the modulation by noise is also discussed.

621.396.822.1 : 621.396.41 : 621.396.619.16 **204**

Study of Crosstalk in Multiplex Systems using Pulse-Position Modulation.—Gardère & Oswald. (*See* 224.)

621.397.828 **205**

TV Circuits Cause Interference.—(*Tele-Tech*, Sept. 1948, Vol. 7, No. 9, p. 39.) Summary of R.M.A. engineering report issued by the Committee on Television Receivers. Simple precautions at the design stage of television receivers are suggested to prevent interference with radio reception.

621.396.621.029.64 **206**

Microwave Receivers. [Book Review]—S. N. Van Voorhis (Ed.). McGraw-Hill, New York, 1948, 611 pp., $8. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1948, Vol. 36, No. 9, p. 1141.) Volume 23 of the Radiation Laboratory series. "The present-day microwave engineer . . . will find a large amount of material that he can use directly, and from the rest he will get many helpful leads. This book is recommended to him without reservation." For another review see *Wireless Engr*, Sept. 1948, Vol. 25, No. 300, p. 302.

STATIONS AND COMMUNICATION SYSTEMS

621.39 + 534.756 **207**

Relationship between Rate of Transmission of Information, Frequency Bandwidth, and Signal-to-Noise Ratio.—Earp. (*See* 62.)

621.394.441 **208**

Voice Frequency Telegraphy.—S. Rodhe. (*Ericsson Rev.*, 1948, No. 2, pp. 54–64.) An outline of the broad principles of the Ericsson system, with a detailed discussion of the methods of modulation and demodulation.

621.394.441 : 621.396.615 **209**

Stabilized Oscillator for Multiplex Voice-Frequency Telegraphy.—G. Delyon & M. Manière. (*Câbles & Transmission, Paris*, July 1948, Vol. 2, No. 3, pp. 209–218. With English summary.) The causes of frequency instability in various common types of oscillator are examined theoretically and also experimentally. A simple feedback pentode circuit is described, which includes a compensating resistance in the grid circuit and feeds into a 500-Ω load. No thermostat is used. Frequency stability is within 1 c/s for a temperature variation from 5° to 50°C and for supply voltage variations of ±5%, so that full use can be made of the bandwidth of the channel filters.

621.394.5 : 621.396.65 : 621.394.33 **210**

International Automatic Telegraph Networks : Part 1.—J. D. M. Robinson. (*J. Brit. Instn Radio Engrs*, Nov./Dec. 1947, Vol. 7, No. 7, pp. 266–283. Discussion, pp. 284–285.) War-time developments in the long-distance telegraph techniques of the fighting services of the British Commonwealth and the U.S.A. open up new possibilities in international communications. The problem of providing an international network of greatly enhanced scope and efficiency is analysed, with particular reference to the 'message storage' inter-circuit technique developed by the U.S. army. This technique could form the basis of a greatly improved system, provided a single telegraph code and alphabet could be adopted universally. The various automatic systems are considered briefly, inter-circuit techniques with either manual or automatic routing are compared and the main design requirements of the future international automatic telegraph network are outlined. Part 2, 211 below.

621.394.5 : 621.396.65 : 621.394.33 **211**

International Automatic Telegraph Networks : Part 2.—E. V. D. Glazier. (*J. Brit. Instn Radio Engrs*, Nov./Dec. 1947, Vol. 7, No. 7, pp. 286–297.) Discussion of the problems associated with the design of radio links forming part of an automatic telegraph system, with particular reference to distortion, signal/noise ratio, reduction of misprinting on teleprinter systems, frequency-shift operation, diversity reception and multiplex working. Part 1, 210 above.

621.394/.395].73 : 621.394/.395].645 **212**

Line Amplifier for the Paris-Toulouse Coaxial Cable.—R. Sueur. (*Câbles & Transmission, Paris*, July 1948, Vol. 2, No. 3, pp. 243–250. With English summary.) Discussion of the characteristics of the cable and a detailed description of the amplifier and its use as a unit in each of the 40 repeater stations. The amplifier uses a special long-life pentode and has two parallel amplification paths with a common negative feedback.

621.395.44 : 621.315.052.63 **213**

Power Line Carrier Communications : Part 2.—R. C. Cheek. (*Communications*, Aug. 1948, Vol. 28, No. 8, pp. 26–27, 35.) Discussion of (*a*) single-frequency automatic simplex and multi-station duplex systems, and (*b*) different types of calling systems. Part 1, 819 of 1948.

621.396.41 : 621.396.65 **214**

The Multiplex Radio Link between Corsica and the Mainland.—P. Rivère. (*Onde élect.*, July & Aug./Sept. 1948, Vol. 28, Nos. 256 & 257, pp. 259–267 & 337–344.) See 3508 of 1948.

621.396.5(494) : 621.396.41 **215**

The Zurich-Geneva Multichannel Radiotelephone Link in Public Trial Service.—W. Steinmann & E. Huber. (*Brown Boveri Rev.*, March/April 1948, Vol. 35, Nos. 3/4, pp. 111–115.) Topographical conditions make it relatively easy to establish beam R/T links in Switzerland, where the links are needed to supplement existing line and cable networks for trunk telephony. Details are given of the Zürich–Metliberg–Chasseral–Geneva link, which is the first part of such a network.

621.396.619.13 **216**

Frequency Modulation.—"Cathode Ray". (*Wireless World*, Sept. 1948, Vol. 54, No. 9, pp. 339–343.) An elementary discussion of the points that seem to cause most confusion.

621.396.619.13 **217**

Practical Use of Frequency Modulation on Amateur Frequencies.—D. N. Corfield. (*Proc. R.S.G.B.*, 1948, No. 4, pp. 1–7.) Discussion of equipment used and results obtained using f.m. in the 58.5–60-Mc/s amateur band. The essential differences between f.m. and a.m. transmission and reception are also considered.

621.396.65 **218**

[London] **Overseas Exchange (Radio Services).**—R. C. Devereux. (*P. O. elect. Engrs' J.*, July 1948, Vol. 41, Part 2, pp. 76–82.) An account of the facilities and equipment of the new exchange opened in November 1947 to handle exclusively the large volume of traffic from Great Britain and Europe to all parts of the world. The layout of the switchroom, connections with the two R/T terminals in London and at Hendon, circuit and control arrangements, and operation of the service, are described briefly.

621.396.65 **219**

Indirect Microwave Relay System.—R. R. Wakeman. (*Tele-Tech*, Sept. 1948, Vol. 7, No. 9, pp. 42–43, 106.) Plane reflectors which require no external power source are used as auxiliary relays when obstacles intervene between transmitter and receiver. Relay stations need not then be intervisible.

621.396.65 : 621.396.615.142.2 **220**

ST [studio/transmitter] **Equipment using Klystrons.**—(*FM & Televis.*, July 1948, Vol. 8, No. 7, pp. 21–23.) A f.m. radio link designed primarily for high-fidelity broadcast service. It can also be adapted for the transmission of wide-band modulation, the limits of which fall within the design of the system. Sperry Type SRL-17 reflex klystrons are used for both transmitter and superheterodyne receiver. The frequency range is 920–960 Mc/s. A.f.c. and monitoring facilities are provided. Construction and performance details are given.

621.396.65.029.64 **221**

Repeater Buildings for the First Radio Relay System.—W. L. Tierney. (*Bell Lab. Rec.*, July 1948, Vol. 26, No. 7, pp. 281–288.) The buildings, normally unattended, are identical in structure, except that the central and the four corner supporting columns are continued through the roof for the three stations requiring aerials above roof level. Standby power supplies are available ; power failures are automatically indicated at a remote maintenance station. See also 1755 of 1948 (Durkee).

621.396.712(489) **222**

Copenhagen Broadcasting House.—F. Heegaard & E. Cohrt. (*Elect. Commun.*, June 1948, Vol. 25, No. 2, pp. 106–112.) A general description. See also 2938 of 1947.

621.396.72 : 621.398 **223**

Unattended Low-Power Transmitting Stations with Remote Control.—F. C. McLean & R. Toombs. (*B.B.C. Quart.*, July 1948, Vol. 3, No. 2, pp. 122–128.) Discussion of the transmitter building, the aerial and earth system and the design of the remote-control system for the duplicate crystal-controlled 1 474-kc/s 2-kW transmitters used at each station. The combined initial and operating costs are much less for unattended stations than for attended stations of comparable size.

621.396.822.1 : 621.396.41 : 621.396.619.16 **224**

Study of Crosstalk in Multiplex Systems using Pulse-Position Modulation.—H. Gardère & J. Oswald. (*Câbles & Transmission, Paris*, July 1948, Vol. 2, No. 3, pp. 173–193. With English summary.) Crosstalk is largely due to the displacement of one pulse caused by elongation of the preceding pulse ; it is zero for ideal square pulses, but even if pulses with an infinitely steep front could be obtained, they would be distorted in passage through the various quadripoles of the system. Examples show that the distortion arises from the limitation of the pass band and from imperfect linearity of the phase/frequency curve, two effects which are closely connected. The effect of a low-pass filter on pulses of various shapes is studied and the crosstalk for each case is calculated as a function of bandwidth. The results can be extended to other quadripoles, particularly band-pass filters ; the study can form a basis for a more general theory.

621.396.931 **225**

Technical Aspects of Experimental Public Telephone Service on Railroad Trains.—N. Monk & S. B. Wright. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1948, Vol. 36, No. 9, pp. 1146–1152.) 1948 I.R.E. National Convention paper. " Describes component parts of the train telephone system, results of radio coverage tests on the routes involved, and devices employed to control two-way transmission. Special features of the installations which differ from previous mobile installations and some results of the experimental operation are pointed out."

621.396.931 **226**

V.H.F. Railroad Radio Link.—P. B. Patton. (*Communications*, July 1948, Vol. 28, No. 7, pp. 16..33.) Details of the equipment and results obtained for a 44-mile duplex f.m. radio link using frequencies of about 160 Mc/s. Simultaneous 6-channel operation was obtained by single-sideband working. Five of the channels were for telephony ; the sixth could be used for five pulse-signalling and two teletype channels with sub-channel carrier frequencies in the voice-frequency range. The 6 main channels were spaced at 4-kc/s intervals. The aerials were vertically polarized 16-element arrays.

621.396.931 **227**

Compact Universal Mobile Unit : Parts 1 & 2.—L. P. Morris. (*FM & Televis.*, July & Aug. 1948, Vol. 8, Nos. 7 & 8, pp. 34–38 & 19–22.) Circuit details of a vehicle-dispatcher equipment, for single- or dual-frequency use, with optional selective calling.

621.396.931.029.62 **228**

A Multi-Carrier V.H.F. Police Radio Scheme.—J. R. Brinkley. (*J. Brit. Instn Radio Engrs*, May/June 1948, Vol. 8, No. 3, pp. 128–142. Discussion, pp. 143–147.) A full description of the system noted in 1163 of 1948.

621.396.932 : 621.396.5 **229**

The 248A Marine Radio Telephone Equipment.—R. C. Newhouse. (*Bell Lab. Rec.*, July 1948, Vol. 26, No. 7, pp. 294–297.) For communication with either coastal radio stations or other ships. The transmitting power is 250 W, and any one of 30 crystal-controlled frequencies in the range 2–18 Mc/s may be used.

SUBSIDIARY APPARATUS

621.352.7 **230**

Fresh Progress in Dry Batteries : the Vidor " Kalium " Cell.—R. W. Hallows. (*Wireless World*, Oct. 1948, Vol. 54, No. 10, pp. 352–354.) The cell supplies a constant e.m.f. of 1.25–1.4 V for long periods under load. The use of HgO enables depolarization to keep pace with electrolytic action, so that the objectionable sawteeth of the Leclanché cell discharge curve are absent. The ' Kalium ' cell costs considerably more than the Leclanché type.

621.396.68 : 621.316.722 **231**

Stabilized Power Supplies : Part 1 — Practical Design Procedure for Series-Valve Types.—M. G. Scroggie. (*Wireless World*, Oct. 1948, Vol. 54, No. 10, pp. 373–378.) Basic principles are discussed. Design is simplified by the use of valve characteristics and load-current/voltage diagrams. See also 197 of 1944 (Hogg).

621-526 **232**

Theory of Servomechanisms. [Book Review]—H. M. James, N. B. Nichols & R. S. Phillips (Eds). McGraw-Hill, New York and London, 1947, 375 pp., $5. (*Nature, Lond.*, 26th June 1948, Vol. 161, No. 4104, p. 994.) No. 25 of the Radiation Laboratory series. Only linear systems are discussed. One of the first major works to be published on the subject. " This book . . . will be welcomed universally."

TELEVISION AND PHOTOTELEGRAPHY

621.397.26 **233**

Possibilities of Stratovision.—M. B. Sleeper. (*FM & Televis.*, Aug. 1948, Vol. 8, No. 8, pp. 15–17, 45.) Illustrations and short discussion of Westinghouse equipment installed in a Martin-202 aircraft. In a demonstration at Zanesville, Ohio, the aircraft flew at a height of 25 000 ft, picked up signals on channel No. 2 from WMAR-TV, Baltimore, and rebroadcast them on channel No. 6. Excellent reception of the rebroadcast signals was obtained at distances of over 200 miles. Some interference was experienced, because the aircraft picked up signals from WNBT, New York City, also operating on channel No. 2. With the present limited number of channels available for allocation to ground stations in U.S.A., the aircraft will always be liable to pick up signals from two or more stations using the same channel, and its transmissions may interfere with those from one or more ground stations. This difficulty would appear to make stratovision impracticable on the lower frequency band. The possibility of using frequencies from 475 to 890 Mc/s is briefly considered.

621.397.331.2 **234**

New Design for Medium Definition TV Camera System.—J. B. Sherman. (*Tele-Tech*, Sept. 1948, Vol. 7, No. 9, pp. 52–55.) Description of experimental iconoscope Type 5527, with full circuit diagrams. The scanning circuits provide 250-line resolution with interlace ratios of 2/1, 3/1 or 4/1 on a 7-inch viewing tube with e.s. deflection. A small motor, with clutch to prevent over-travel, is used for optical focusing, with the controls mounted on the main chassis.

621.397.331.2 : [621.395.625.6 + 771.3 **235**

Television Transcription by Motion Picture Film.—T. T. Goldsmith, Jr, & H. Milholland. (*J. Soc. Mot. Pict. Engrs*, Aug. 1948, Vol. 51, No. 2, pp. 107–113. Discussion, pp. 113–116.) Description of the electronic and camera equipment for recording television pictures and sound on film, the pictures being recorded directly from the face of the c.r. tube. Applications to documentary recording, theatre television projection, etc., are discussed. See also 236 below.

621.397.331.2 : 621.395.625.6 **236**

Television Recording Camera.—J. L. Boon, W. Feldman & J. Stoiber. (*J. Soc. Mot. Pict. Engrs*, Aug. 1948, Vol. 51, No. 2, pp. 117–126.) Description of the principal features of a 16-mm camera for recording at sound speed directly from a monitor receiving c.r. tube. See also 235 above.

621.397.5 : 535.88 **237**

Developments in Large-Screen Television.—R. V. Little, Jr. (*J. Soc. Mot. Pict. Engrs*, July 1948, Vol. 51, No. 1, pp. 37–46. Discussion, pp. 47–51.) Description of light source, optical system, screen and h.v. power units of experimental equipment.

621.397.5 : 535.88 **238**

Optical Problems in Large-Screen Television.—I. G. Maloff. (*J. Soc. Mot. Pict. Engrs*, July 1948, Vol. 51, No. 1, pp. 30–36. Discussion, pp. 47–51.) General discussion, with details of one pre-war and two post-war R.C.A. large-screen projectors.

621.397.5 : 535.88 : 535.317.9 **239**

The Manufacture of Correction Plates for Schmidt Optical Systems.—Rinia & van Alphen. (*See* 63.)

621.397.5 : 535.88 : 791 **240**

Development of Theater Television in England.—A. G. D. West. (*J. Soc. Mot. Pict. Engrs*, Aug. 1948, Vol. 51, No. 2, pp. 127–167. Discussion, pp. 167–168.) A historical review of progress in large-screen television projection, both before and after the war, and a description of the design and performance of equipment developed for the distribution and projection of television programmes. Proposals now being made for setting up a theatre television service, first in London, and then throughout Great Britain, are discussed.

621.397.61 : 621.317.3 **241**

TV Transmitter Design : Part 4.—Hamilton. (*See* 138.)

621.397.7 **242**

Salute to WPIX : Blueprint for Engineering a Television Station.—(*Tele-Tech*, July 1948, Vol. 7, No. 7, pp. 33–56.) An account of its construction, operation and facilities. The station was built as extra floors to the Daily News Building, New York, the aerial and tower being mounted on top of the 37th floor. The transmitter delivers 5 kW video power and 2.5 kW f.m. sound signal to the aerial transmission line. Output is approximately 18 kW. The studio control room, located at one end and above the floor of the studio, is divided into two levels, concerned respectively with technical and programme control. The master control for the station provides complete monitoring of sight and sound signals. Problems associated with transmission from films are also discussed. The acoustic treatment of the studio involved the construction of a 'room within a room'. Transmissions from mobile stations are also relayed.

621.397.743 : 621.396.67 **243**

Television Antenna and R.F. Distribution Systems for Apartment Houses.—H. E. Kallmann. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1948, Vol. 36, No. 9, pp. 1153–1160.) Discussion of requirements, and description of amplifiers and distribution networks which supply boosted signals of all available stations on their original carriers to all receivers in an apartment house.

TRANSMISSION

621.316.726.078.3 **244**

Frequency Stabilization in the Region of 10 000 Mc/s.—Donnelly. (*See* 136.)

621.394.61 **245**

10 kW Short-Wave Telegraphy Transmitter.—M. G. Favre. (*Brown Boveri Rev.*, March/April 1948, Vol. 35, Nos. 3/4, pp. 85–90.) Overall efficiency is 45%, so that operating costs are low. Installation and operation are simple. The high voltage is only 6 kV and CuO rectifiers are used. The keying speed is 750 words/minute. See also 1615 of 1947 (Guyer & Favre).

621.396.619.23 **246**

A Broad-Band High-Level Modulator.—R. J. Rockwell. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1948, Vol. 36, No. 9, pp. 1160–1164.) The class-B modulator has a broad pass-band with uniform gain and low distortion and noise level. Broad-band feedback and a cathode follower are used ; there is no modulation transformer.

VALVES AND THERMIONICS

621.383.5 : 538.567.2 **247**

The Photo-Voltaic Effect.—Lehovec. (*See* 73.)

621.385+621.314.6 **248**

Transmitting and Rectifier Tubes.—R. Kesselring. (*Brown Boveri Rev.*, March/April 1948, Vol. 35, Nos. 3/4, pp. 99–103.) Details of various Brown Boveri types. See also 1634 of 1947 and 2967 of 1948 (Jenny).

621.385 : 621.396.822 **249**

Induced Grid Noise and Total-Emission Noise.—A. van der Ziel & A. Versnel. (*Philips Res. Rep.*, Feb. 1948, Vol. 3, No. 1, pp. 13–23.) Measurements are given of the noise resonance curve of the input circuit of pentodes for λ 7.25 m. The asymmetry of this curve is due to the phase relationship between the induced grid noise and the normal shot-effect noise. For diodes in the 7.25-m cut-off region, the total-emission noise can be calculated by assuming that the equivalent noise temperature of the total-emission conductance is equal to the cathode temperature.

621.385.029.63/.64 **250**

Nonlinear Phenomena in Travelling-Wave Valves.—O. Doehler & W. Kleen. (*Ann. Radioélect.*, April 1948, Vol. 3, No. 12, pp. 124–143.) Continuation of 602 of 1948. The limit of output and useful power is calculated, taking account of the nonlinearity of the gain. A method of development in series and successive approximation is used, similar to that employed by Warnecke, Bernier & Guénard (2215 of 1945) for calculating the effect of space charge in the drift space of a klystron. Only the energy corresponding to the excess of electron velocity over wave velocity can be transferred from the electron beam to the wave and transformed into u.h.f. energy. The electrons are retarded by the field of the travelling wave, and once this retardation has reduced the electron velocity to the wave velocity, the power can increase no further. Space charge effects and the action of radial electric fields on the electrons also tend to reduce useful power and output.

621.385.029.63/.64 : 537.525.92 **251**

On the Effect of the Space Charge in the Travelling-Wave Valve.—O. Doehler & W. Kleen. (*Ann. Radioélect.*, July 1948, Vol. 3, No. 13, pp. 184–188.) The method of successive approximations applied by Warnecke, Bernier & Guénard (2215 of 1945) to study the effects of space charge in the drift space of a klystron, is here applied to the travelling-wave valve. The treatment is limited to the case of small signals. The electron beam is assumed to be (*a*) narrow with respect to the dimensions of the cross-section of the retarding line, (*b*) infinitely wide. In the travelling-wave valve the space charge effects can either increase or decrease the valve gain, according to the conditions of operation. See also 602 of 1948 and 250 above.

621.385.029.63/.64 : 621.392.5 **252**

Experimental Method for *a priori* Tests of Delay Lines for the Travelling-Wave Amplifier.—Lapostolle. (*See* 39.)

621.385.032.216 : 537.533 **253**

The Mechanism of the Thermionic Emission from Oxide Coated Cathodes.—H. Friedenstein, S. L. Martin & G. L. Munday. (*Rep. Progr. Phys.*, 1946/1947, Vol. 11, pp. 298–339. Bibliography, pp. 339–341.) A historical account is given of the main experimental data so far obtained on the general behaviour of oxide cathodes. The mechanism of normal emission is considered both experimentally and theoretically, with special reference to the Wilson and de Boer models of the process. Neither is as yet completely established, but recent work tends to favour the de Boer model. The fundamental difficulty appears to be the lack of knowledge of the way in which the excess alkaline-earth metal is built into the oxide. Recent research on emission under pulsed conditions has led to a revival of Riemann's conception of a potential barrier at the core/coating interface.

621.385.1 **254**

The Consequences of an Electron-Inertia Effect in Valves.—M. J. O. Strutt & A. van der Ziel. (*Physica, 's Grav.*, Jan. 1941, Vol. 8, No. 1, pp. 81–108. In German, with English summary.) Discussion of the currents flowing to the various electrodes of a valve when a small bunch of electrons starts from the cathode, and of the case of periodic pulses from the cathode. In certain cases only d.c. flows to the anode as a result of such pulses. With an alternating voltage between the input grid and the cathode, the pulse shape may differ widely from the voltage curve. Different paths in a valve for different electrons may result in curious effects such as rectification or frequency multiplication. A single sinusoidal voltage pulse on the input grid is considered and the minimum values of input resistance and amplification are deduced. The lower limit of amplification is 0.5 for multi-electrode valves and is >1 for secondary-emission valves at any frequency, however high. Induction effects are caused by the passage of electrons near to conductors inside valves; simple formulae are derived for the displacement currents. For the rapid calculation of phase angles a 'centre of gravity theorem' is enunciated. Simple deductions are made for the case of transit-time modulation.

621.385.1 : 621.396.822 **255**

Fluctuations and Electron Inertia.—C. J. Bakker. (*Physica, 's Grav.*, Jan. 1941, Vol. 8, No. 1, pp. 23–43. In English.) The shot effect in valves gives rise, by induction, to fluctuating displacement currents towards the valve grids, whose negative potential prevents electrons from reaching them. The fluctuating currents in the control-grid/cathode lead have been investigated experimentally for two types of valve. The results obtained are in satisfactory agreement with theory.

621.385.1.012 **256**

Dynamic Methods for the Determination of Valve Characteristics.—G. Gregoretti. (*Alta Frequenza*, June 1948, Vol. 17, No. 3, pp. 110–127. In Italian, with English, French and German summaries.) Static methods cannot be used with safety for transmitting valves on account of the risk of damage if normal operating voltages are applied. Various practical pulse methods are described. Differences between the results obtained by the different methods are analysed.

621.385.38.001.8 **257**

Thyratrons and their Industrial Applications.—J. Martin. (*Bull. Soc. franç. Élect.*, July 1948, Vol. 8, No. 83, pp. 371–384.) Detailed description of the construction and performance of a thyratron (VHC 3/1000) made by the Société française radioélectrique, and also circuit diagrams and discussion of numerous applications.

621.385.5.001.8 : 621.392 **258**

Applications of Screen-Grid Supply Impedance in Pentodes.—P. G. Sulzer. (*Communications*, Aug. 1948, Vol. 28, No. 8, pp. 10–11..39.) The anode-current/grid-voltage characteristic of a pentode with negative suppressor-grid voltage and an impedance in the screen-grid circuit can have a negative slope. This property is used in circuits suggested for phase inverters, d.c. and a.c. coupled trigger circuits and negative-resistance oscillators.

621.396.615.141.2 **259**

The Frequency Stability of Magnetron Oscillations of the Dynatron Type.—N. S. Zinchenko. (*Radiotekhnika, Moscow*, March/April 1948, Vol. 3, No. 2, pp. 40–53. In Russian.) An experimental investigation of the 'dynatron' oscillations of magnetrons for long, short and decimetre waves is described. Curves are plotted showing the frequency variations with the magnetic field, anode voltage and filament current and a formula (p. 42) determining the relative frequency variation in terms of these factors is derived. Conditions necessary for frequency stability are established. The stabilities of magnetron and valve oscillators operating as dynatrons are compared. Curves showing the effect of the grid voltage on the stability of split-anode magnetrons are also plotted.

621.396.615.141.2 **260**

The Rotating Space Charge in a Whole-Anode Magnetron.—I. I. Vasserman (Wassermann). (*Zh. tekh. Fiz.*, June 1948, Vol. 18, No. 6, pp. 785–792. In Russian.) The critical current corresponding to the rotating space charge of a magnetron is calculated and compared with experimental results. The rotating current is proportional to the product of the charge density and the tangential velocity of the electrons. The experimental results seem to support the theory of Brillouin that the radial velocity of electrons is zero at all points of the inter-electrode space and that the electrons move in circular orbits whose centres are on the cathode, rather than the theory of Moller, Braude, Page and Adams that the radial velocity is zero at only one point on the surface of the anode and that the electrons describe cardioid orbits.

621.396.615.141.2 **261**

On the Properties of Valves using a Constant Magnetic Field: Parts 1 & 2.—O. Doehler. (*Ann. Radioélect.*, Jan. & July 1948, Vol. 3, Nos. 11 & 13, pp. 29–39 & 169–183.) Part 1 discusses the static and dynamic characteristics of the magnetron. From Brillouin's work (1892 of 1943), formulae are derived which define the space charge, the distribution of potential and the characteristics for magnetic fields below the critical value. The oscillation frequencies of multicavity magnetrons are calculated; the results are in good agreement with measured values. Corrections are given at the end of part 2.

In part 2 the treatment is extended to high-power resonance oscillations excited in the region above the critical point. The differences between these oscillations and electron oscillations are examined and a quantitative relation is established which gives the optimum operating conditions. The input impedances and the output are calculated and an empirical relation between the anode current and the migration current is given. The dynamic electron trajectories in a plane magnetron without space charge are determined, by way of introduction to the study of the travelling-wave valve. To be continued.

621.396.615.142.1 **262**

On Some Typical Models of Velocity-Modulation Valves.—R. Warnecke. (*Ann. Radioélect.*, April 1948, Vol. 3, No. 12, pp. 71–106.) A detailed account of the construction and characteristics of (*a*) reflex klystrons for low-power oscillators for receivers or transmitters operating in the 3-, 10- and 20-cm bands; (*b*) a frequency-multiplier klystron which enables the frequency stability of a quartz oscillator to be transferred to the 10-cm band; (*c*) a 2-cavity klystron with a h.f. output in the 10-cm band of more than 1 kW. Reprinted in *Onde élect.*, May–July 1948, Vol. 28, Nos. 254–256, pp. 175–185, 243–256 & 287–294.

621.396.615.142.2 **263**

Multifrequency Bunching in Reflex Klystrons.—W. H. Huggins. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1948, Vol. 36, No. 9, p. 1145.) Corrections to 2988 of 1948.

621.396.645 : 537.311.33 : 621.315.59 **264**

The Transistor, a Semi-Conductor Triode.—J. Bardeen & W. H. Brattain. (*Phys. Rev.*, 15th July 1948, Vol. 74, No. 2, pp. 230–231.) A short account of the basic principles of the triode device discussed in detail in 265 below. Such units have been operated as amplifiers at frequencies up to 10 Mc/s. Relevant theory is also given in articles noted in 3438 of 1948 (Shockley & Pearson) and 3439 of 1948 (Brattain & Bardeen). For another account of the transistor see *Electronics*, Sept. 1948, Vol. 21, No. 9, pp. 68–71 (D.G.F. & F.H.R.).

621.396.645 : 537.311.33 : 621.315.59 **265**

Experimental Germanium Crystal Amplifier [the Transistor].—W. Wells : S. Y. White. (*Audio Engng, N.Y.*, July & Aug. 1948, Vol. 32, Nos. 7 & 8, pp. 6, 8 & 28–29, 39.) The crystals used for the 'transistor' developed by the Bell Laboratories belong to the class whose unidirectional conductivity characteristics are derived from imperfections in the crystal lattice introduced by impurities in the material. In this particular case the Ge crystal contains small amounts of Sn, interspersed between the Ge atoms in the crystal lattice. Between the inner and outer electron shells of the Ge atom there exists a zone whose force fields do not permit the existence of orbital electrons under normal circumstances. The proximity of the Sn atom so distorts these force fields that the 4 electrons from the 'O' shell of the Sn atom may circulate in this 'forbidden shell' of the Ge atom. These borrowed electrons have a higher binding energy than the 4 electrons in the 'N' shell of the Ge atom and consequently require a greater potential difference between the contact and the crystal for their release. When the contact point is made sufficiently positive in relation to the crystal, the orbits of these borrowed electrons expand, allowing them to come within the outer zone where conductivity may take place. Conversely, as the potential of the contact is made negative relative to the crystal, the orbits of the borrowed electrons shrink, placing them in a zone where they are no longer available for participation in conductivity. A fairly high potential will therefore be required to maintain a current flow between a negatively charged contact point and the crystal, since the borrowed electrons will be pushed down below the zone of activity and only the outer electrons of the Ge atom will take part in the conductivity. If, however, a second contact point is introduced, in close proximity to the first and charged positively, the borrowed electrons will again be elevated to the active region, releasing about twice as many for participation in conductivity. These newly released electrons may take part in the conductivity of both the 'anode' circuit and the 'grid' circuit, so that their effect is that of modulating the current flow of the anode circuit. Energy considerations indicate that a grid input signal of the order of 3 mW would yield an output signal of 60 mW.

Amplification can only take place if $E_g I_g < E_a I_a$. Hence, circuit efficiency must be gained (*a*) by making the electronic paths of the anode and grid contacts through the crystal as nearly coincident as possible, consistent with low cross current flow between the contacts themselves, and (*b*) by using the optimum step-down impedance ratio between the anode circuit of one stage and the grid circuit of the following stage.

Details are given for the construction of experimental amplifiers using Type 1N34 Sylvania Ge crystals and tungsten contact points from Type 1N21 Si crystals. For other accounts of the Transistor see *Bell Lab. Rec.*, Aug. 1948, Vol. 26, No. 8, pp. 321–324 and 264 above.

621.396.645 : 621.385.4 **266**

The FP-54 as a Stable Voltage Amplifier.—Seaton. (*See* 55.)

MISCELLANEOUS

016 : [6(43) + 6(52) **267**

Reports on German and Japanese Industry [up to 31st March 1948]. [Book Notice]—H. M. Stationery Office, London, 1948, 114 pp., 1s. Classified List No. 18, superseding all previous consolidated lists and supplements. Section D includes varnishes and plastics. Section F: electrical engineering industry. Section G: glass and ceramics. Section K: metal industries. Section R: rubber industry.

025.45 **268**

Universal Decimal Classification.—The British Standard publications dealing with this system and mentioned in 1521 of 1948 can be obtained in the U.S.A. from the American Standards Association, Grand Central Terminal Building, 70, East 45th Street, New York City.

5 + 6] : 05(43) **269**

German Scientific and Technical Publications Today.—W. T. Cooper. (*Research, Lond.*, April 1948, Vol. 1, No. 7, pp. 316–319.) An account of the journals now being published in Germany and of methods by which they may be obtained.

621.3 **270**

New Productions. Recent Manufactures of the Société Indépendante de T.S.F.—(*Ann. Radioélect.*, April 1948, Vol. 3, No. 12, pp. 146–150.) These include (*a*) 2-kW and 500-W generators of compact design for industrial h.f. heating; (*b*) telegraphy/telephony transmitter E.H.K.8 for aerodromes, with frequencies in the range 265–415 kc/s; (*c*) high-precision absolute frequency meter covering the wide range from 14 kc/s to 25 Mc/s. This is a large rack-mounted equipment including a 100-kc/s quartz crystal, generators of frequencies 0.1, 1, 10, 1 000 and 10 000 kc/s, harmonic generators, receivers with loop aerials, and suitable apparatus for measuring the beats between the source to be measured and a convenient selected harmonic.

654.1 **271**

Sixth Plenary Meeting of the C.C.I.T., Brussels, May 1948.—F.E.N. (*P.O. elect. Engrs' J.*, July 1948, Vol. 41, Part 2, pp. 108–109.) A short account of the work of the various committees, particularly of the Technical Committee.

621.396 **272**

Essentials of Radio. [Book Review]—M. Slurzberg & W. Osterheld. McGraw-Hill, New York, 1948, 806 pp., $5.00. (*Electronics*, Aug. 1948, Vol. 21, No. 8, pp. 226–227.) "The authors . . have presented here at an intermediate level the principles of operation of the basic circuits and circuit elements used in conventional radio receivers, as essential background knowledge for understanding electronic circuits."

ABSTRACTS and REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

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ACOUSTICS AND AUDIO FREQUENCIES

534.321.9 : 535.61-15 **273**

Supersonic Detection of Infra-Red Radiation.—F. J. Fry & W. J. Fry. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 537–548.) A 932-kc/s standing-wave system is set up in a gas, which is then irradiated with a modulated infra-red beam. The modulation is transferred to the standing-wave pattern and normally the effect decreases with increasing modulation frequency. In gases showing anomalous acoustic absorption, the effect does not fall off in this way; an explanation is suggested.

534.756 + 534.78 **274**

New Possibilities in Speech Transmission.—D. Gabor. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 411–412.) Discussion on 1228 of 1948.

534.851 : 621.395.813 **275**

The Design of Dynamic Noise Suppressors.—H. H. Scott. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 25–37.) For another account see 932 of 1948.

621.395.61 **276**

Parabolic Sound Concentrators.—R. C. Coile. (*J. Soc. Mot. Pict. Engrs*, Sept. 1948, Vol. 51, No. 3, pp. 298–311.) An analytical history of the subject, with detailed references to original work, together with experimental studies on a reflector with aperture 130 cm in diameter. Theoretical work in Russia by L. J. Gutin is found to agree with experimental results for frequency response, amplification and directivity. For the sound field between the focus and the vertex of a paraboloid, a construction based on geometrical optics is derived theoretically and confirmed experimentally.

621.395.625.2 **277**

Transcription Recordings for the Home.—D. G. F. (*Electronics*, Sept. 1948, Vol. 21, No. 9, pp. 86–87.) A $33\frac{1}{3}$-r.p.m. system using vinylite records in which as many as 300 grooves/inch are cut. Noise and distortion are low.

621.395.625.3 **278**

Magnetic Tape Recorder.—H. Lindsay & M. Stolaroff. (*Audio Engng, N.Y.*, Oct. 1948, Vol. 32, No. 10, pp. 13–16.) Design details of the Ampex Model 200A recorder. The frequency range is 30–15 000 c/s, and response is flat to within ± 1 db. Distortion and noise level are claimed to be very low. A low-force tape, Type RR, is used because erasure is easy; its uniform coating results in low modulation noise and uniform output. Playback time can be reproduced within 0.5 sec per half-hour of programme time. High tape speeds, both forward and rewind, are possible. 5 400 ft of 0.002-inch tape can provide 36 minutes of continuous programme time and can be stored on a single 14-inch reel with a 4-inch hub.

534 **279**

Vibration and Sound. [Book Review]—P. M. Morse. McGraw-Hill, New York, 2nd edn 1948, 468 pp., $5.50. (*Electronics*, Sept. 1948, Vol. 21, No. 9, pp. 226, 228.) "A valuable addition to the literature in acoustics, particularly to the serious student and investigator. . . The subject matter is confined for the most part to types of vibrations that can be handled mathematically." The illustrative diagrams are an outstanding feature.

AERIALS AND TRANSMISSION LINES

621.315.2 : 621.317.333.4 **280**

Investigation of Cable Faults in the Case of Discontinuity and Poor Insulation.—L. Dupuis. (*Bull. Soc. franç. Élect.*, Aug./Sept. 1948, Vol. 8, No. 84, pp. 417–418.) Three methods are briefly discussed: (*a*) measurement of the impedance between a conductor and the Pb sheath; (*b*) measurement of the voltage induced by current in a parallel conductor; (*c*) measurement involving the distance between successive maxima, or minima, of the current when the modulation frequency of the applied voltage is swept through the range 0–100 kc/s.

621.315.2 : 621.317.333.4 **281**

Investigation of Faults on Low-Voltage Cables.—C. Philippe. (*Bull. Soc. franç. Élect.*, Aug./Sept. 1948, Vol. 8, No. 84, pp. 439–450.) A detailed account of various methods of fault location used by the Société Nationale des Chemins de Fer Français on their signal, telephony and power networks.

621.315.2 : 621.317.333.4 : 621.3.015.33 **282**

Application of Pulse Methods to Fault Location on Cables.—G. Le Parquier. (*Bull. Soc. franç. Élect.*, Aug./Sept. 1948, Vol. 8, No. 84, pp. 434–438.) An outline of apparatus and methods using a 600-W generator giving extremely short pulses. Echoes received from faults are displayed on the screen of a c.r.o., together with the initial pulse. Marking pips are provided at 6.67-μs intervals, corresponding to distances of 1 km in free space. The marking scale can be adjusted to make one of the pips coincide with the echo in order to obtain greater reading accuracy. Typical oscillograms illustrate the results obtained with different kinds of fault.

621.315.2 : 621.317.333.4 : 621.317.733 **283**

Application of the de Sauty Bridge to Fault Finding on Very Long Cables.—H. Josse & R. Tellier. (*Bull. Soc. franç. Élect.*, Aug./Sept. 1948, Vol. 8, No. 84, pp. 427–429.) The de Sauty bridge gives results which differ from the true values, even for cable lengths <10 km. The discrepancies increase with increase of cable length, so that a correction is necessary. The correction factor is determined and plotted for cable lengths up to 20 km.

621.315.2 : 621.385 **284**

An Ionic Valve for Clearance of Faults in Cables.—Schmidt. (*See* 559.)

621.315.212 : 621.3.09 **285**

Wave Propagation in Beaded Lines.—R. E. Beam. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 90–96.) The lines are treated as cascade connections of T-sections, each of which represents a length of line with a bead at the centre. Characteristic admittance and propagation constants are derived, and curves are included to illustrate the variation of these quantities with bead spacing for a number of R.M.A. standard coaxial cables.

621.315.23 : 621.317.333.4 **286**

Investigation of Faults in Underground Cables.—H. Aschère. (*Bull. Soc. franç. Élect.*, Aug./Sept. 1948, Vol. 8, No. 84, pp. 397–412.) The various types of fault are discussed and classified. Methods for locating faults are reviewed and their advantages and disadvantages are compared.

621.315.23 : 621.317.333.4 **287**

Investigation of Faults in Underground Cables.—R. Bourdon : E. Masson. (*Bull. Soc. franç. Élect.*, Aug./Sept. 1948, Vol. 8, No. 84, pp. 413–416.) Comment on 286 above.

621.315.23 : 621.317.333.4 **288**

Investigation of Cable Faults in Underground Cables.—M. Roger. (*Bull. Soc. franç. Élect.*, Aug./Sept. 1948, Vol. 8, No. 84, pp. 419–426.) An account of test methods and apparatus used by the Centre de Distribution de Paris-Électricité, with a few results for cables already installed.

621.315.23 : 621.317.333.4 **289**

Detection of Faults in Underground Cables by Ground Vibration.—E. Marchand. (*Bull. Soc. franç. Élect.*, Aug./Sept. 1948, Vol. 8, No. 84, p. 433.) The vibrations are picked up by means of a granule microphone, the resulting voltage being amplified and finally applied to an indicator. If the curve shown on the indicator is oscillatory, there is a fault ; if it is not periodic, there is none. The method has been used successfully on 60-kV supply cables.

621.392.029.64 : 621.392.26† **290**

Waveguides.—In future the recently-proposed U.D.C. number 621.392.26† will be used for waveguides instead of 621.392.029.64, the least unsatisfactory number previously available.

621.392.26† **291**

On Representing the Field in a Waveguide as a Sum of the TE and TM Fields.—A. A. Samarski & A. N. Tikhonov. (*Zh. tekh. Fiz.*, July 1948, Vol. 18, No. 7, pp. 959–970. In Russian.) It has been stated by various authors without proof that any field in a waveguide can be represented as a sum of the transverse electric field TE and the transverse magnetic field TM. A rigorous mathematical proof is given that any e.m. field in a waveguide can be represented by two Hertzian vectors, each having only one component differing from zero. The problem of determining the e.m. field in a waveguide is then reduced to the problem of finding two scalar functions Z_b and Z_m (transverse components of the electric and magnetic Hertzian vectors).

621.392.26† **292**

Remarks on Slow Waves in Cylindrical Guides.—A. A. Oliner. (*Elect. Commun.*, June 1948, Vol. 25, No. 2, pp. 157–159.) An alternative method for deriving certain relations obtained in 22 of 1948 (Frankel) and 334 of 1948 (Bruck & Wicher), together with graphs of certain Bessel-function combinations which can be used to simplify the calculations.

621.392.26† **293**

A Critical Study of Variational and Finite-Difference Methods for Calculating the Operating Characteristics of Wave Guides and Other Electromagnetic Devices.—R. M. Soria & T. J. Higgins. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 670–679.) Discussion of the relative merits of various methods for obtaining approximately the characteristic values and the e.m. fields associated with waveguides and other bounded hollow devices, when exact analytical solution is impossible. Each of these methods is applied to the calculation of characteristic values and e.m. fields of both TM and TE modes in waveguides of various cross-sections.

621.392.26† **294**

A Waveguide Branching Filter.—W. D. Lewis. (*Bell Lab. Rec.*, Sept. 1948, Vol. 26, No. 9, pp. 372–376.) Equipment for frequencies around 4 000 Mc/s. The system uses 4-arm waveguide hybrids in conjunction with band reflection filters made from a length of waveguide with three screw-probes λ/4 apart. A tandem arrangement for a 5-channel branching filter is described.

621.392.26† + 621.396.611.4] : 517.564.3 **295**

Some Bessel Equations and their Application to Guide and Cavity Theory.—Kline. (*See* 416.)

621.392.26† + 621.315] : 621.3.09 **296**

Electromagnetic Waves in Wave Guides : Part 1.—W. Opechowski. (*Philips tech. Rev.*, July 1948, Vol. 10, No. 1, pp. 13–25.) The commonly accepted theory of transmission lines and resonant circuits has only limited validity for waveguides. The theory of propagation is here developed from the fundamental Maxwell equations. Methods of solving these equations are summarized and the properties of rectangular waveguides are considered ; cylindrical waveguides will be considered in part 2.

621.392.26† + 621.315.212] : 621.3.09 **297**

Electromagnetic Waves in Wave Guides : Part 2 — Coaxial Cables and Circular Wave Guides.—W. Opechowski. (*Philips tech. Rev.*, Aug. 1948, Vol. 10, No. 2, pp. 46–54.) Possible modes of propagation in conductors of circular cross-section and cylindrical symmetry are deduced by a direct solution of Maxwell's equations. Part 1 : 296 above.

621.392.26† : 517.564.3 **298**

Table of Roots for Natural Frequencies in Coaxial Type Cavities.—Dwight. (*See* 417.)

621.392.26† : 621.3.09 **299**

Higher Mode Techniques for Wave Guides.—W. M. Goodhue. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, p. 162.) Summary only. Mode filters permit the transmission of either a pure first mode or of a pure higher mode at will, in a waveguide whose dimensions greatly exceed the critical dimensions. Apparatus has been developed for excitation of pure modes, mode filtering, matching, loading, and measurement of field distribution and of standing waves, in large guides. Frequencies up to five times the cut-off frequency have been propagated without degeneration.

621.392.26† : 621.3.09 **300**

Multiplex Transmission through Wave Guides using Higher Order Modes.—G. R. Buss, W. A. Hughes, H. D. Ross & A. B. Bronwell. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 163–179.) The possibility of transmitting two or more signals through a waveguide on the same carrier frequency, but using different modes to separate the signals, is investigated both experimentally and theoretically. Signals can be well separated by mode differences alone. Transmission through gradual bends and tapered sections does not introduce serious mode scrambling. Various aerial systems for setting up higher-order modes in rectangular and circular waveguides are analysed.

621.396.67 + 621.396.621 **301**

Pattern for F.M. Profits : Part 5 — Receiver and Antenna.—Black. (*See* 495.)

621.396.67 **302**

The Theoretical Precision with which an Arbitrary Radiation-Pattern may be Obtained from a Source of Finite Size.—P. M. Woodward & J. D. Lawson. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 363–370 ; summary, *ibid.*, Part I, Sept. 1948, Vol. 95, No. 93, p. 405.) It is possible to approximate as closely as desired to a specified radiation-pattern by a suitable distribution of field over an aperture of given size, though the necessary currents in the conducting elements of the source would in general be prohibitively large in comparison with the power radiated. The same is true for a linear array of given length if no limit is set to the number of elements. The treatment here presented differs essentially from that of Schelkunoff (1890 of 1943) and can be applied equally well to continuous source-distributions of field or to arrays of discrete source elements.

621.396.67 **303**

High Gain with Discone Antennas.—A. G. Kandoian, W. Sichak & R. A. Felsenheld. (*Elect. Commun.*, June 1948, Vol. 25, No. 2, pp. 139–147.) The discone aerial was discussed in 1180 of 1946 (Kandoian). Two systems of such aerials are here considered : (*a*) an omnidirectional system consisting of 9 aerials stacked vertically, operating at frequencies between 960 and 1 215 Mc/s, (*b*) a unidirectional pencil-beam system in which a single discone aerial is placed at the focus of a paraboloid reflector : the s.w.r. is <2 over the frequency range 700–3 100 Mc/s. Reprinted from *Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 336–346

621.396.67 **304**

8-Bay Pylon Antenna.—O. O. Fiet. (*FM & Televis.*, Sept. 1948, Vol. 8, No. 9, pp. 46–48, 60.) Detailed description of the aerial, which has contours of field strength that are nearly circular for both 20 and 1 000 μV/m with an input of 50 kW. A primary coverage up to 200 miles is obtained.

621.396.67 **305**

Antenna Design for Television and F.M. Reception.—F. A. Kolster. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, pp. 1242–1248.) Discussion of : (*a*) an approximate method for determining at the preliminary design stage the variation of the resistance and reactance of an aerial with change of frequency or physical dimensions, (*b*) the essential requirements for good performance over the wide band of frequencies necessary for efficient reception of all existing television channels and f.m. bands, (*c*) an aerial system designed for efficient response at all frequencies between 44 and 225 Mc/s.

621.396.67 **306**

Helical Beam Antennas for Wide-Band Applications.—J. D. Kraus. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, pp. 1236–1242.) Over a wide frequency band, the pattern shape, circularity of polarization, and terminal impedance are relatively stable. Measured performance data are included for a medium-gain aerial of optimum dimensions with a bandwidth of about 1.7 : 1. A high-gain broadside array of four such aerials is described and other applications are discussed.

621.396.671 **307**

Measurement of Aircraft Antenna Patterns in Flight.—J. S. Prichard & A. H. Mankin. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, p. 349.) Summary only. Description of an air/ground system which can automatically plot the polar diagram of both horizontally and vertically polarized radiation from an aircraft flying straight and level.

621.396.671 **308**

Ring-Aerial Systems.—H. Page. (*Wireless Engr*, Oct. 1948, Vol. 25, No. 301, pp. 308–315.) Continuation of 1862 of 1948. An investigation of the minimum number of aerials required to give a tolerable approximation to the field of the idealized ring, in which the number of aerials is infinite. Measurement results for a 5-aerial system are given.

621.396.671 **309**

The Patterns of Slotted Cylinder Antennas.—G. Sinclair. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, p. 348.) Summary only. Patterns have been calculated for single slots in cylinders having diameters up to $\lambda/2$. The use of multiple slots is also considered.

621.396.674 **310**

Spaced Loop Aerials.—F. Horner. (*Wireless Engr*, Sept. 1948, Vol. 25, No. 300, pp. 281–285.) Two types of screened loop for use in a v.h.f. coaxial system are compared ; each loop is about 90 cm square. The ' simple ' loop has a screen gap in the centre of one side and output terminals at the centre of the opposite side. The ' twin ' loop has two screen gaps at the centre points of opposite sides and output terminals at the centre of an additional member parallel to, and mid-way between, the sides containing the screen gaps. The ' twin ' loop has three advantages : (*a*) it is easier to test for polarization error, (*b*) the geometrical tolerances in setting it up are less strict, and (*c*) it is mechanically more stable and can be designed with lower moment of inertia. These advantages are achieved with no apparent reduction in sensitivity or in directional accuracy.

621.396.677 **311**

Calculation of Doubly Curved Reflectors for Shaped Beams.—A. S. Dunbar. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, pp. 1289–1296.) A method based upon the conservation of energy and the simple laws of geometrical optics is described, for calculating the double-curvature surfaces required to produce from a point source a beam of arbitrary shape in one plane and uniformly narrow in the perpendicular plane. The method is applied to the case of certain radar aerials for which the optimum elevation pattern is found empirically to be $G(\theta) = K \operatorname{cosec}^2\theta \cos\theta$. Patterns are shown for aerials whose reflectors were computed by this method. Some control of the aerial pattern can be achieved by proper motion of the aerial feed. Errors are discussed.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.015.3 **312**

The Transient Behavior of Non-Linear Systems.—C. S. Roys. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 663–669.) Analysis of the steady-state performance of valve circuits is frequently based on the series expansion for the anode current. This method is extended to provide a general operational procedure for the transient response of nonlinear systems.

621.314.3† **313**

Transductor Fundamentals.—S.-E. Hedstroem & L. F. Borg. (*Electronics*, Sept. 1948, Vol. 21, No. 9, pp. 88–93.) Discussion of : (*a*) types of cores and windings used for transductors or controlled reactors, and methods of self-excitation, (*b*) the mode of operation and control characteristics for single- and multi-element transductors, (*c*) effects of departure of the magnetizing curve from the ideal and the behaviour of a self-excited circuit in pulse operation, and (*d*) applications, and the relative merits of transductors and electronic amplifiers.

621.314.3† **314**

Saturable Reactors and Magnetic Amplifiers.—F. G. Logan. (*Electronics*, Oct. 1948, Vol. 21, No. 10, pp. 104–109.) A general account, in which the most desirable features of self-saturated reactors and magnetic amplifiers are discussed. Tests on reactor core material show a wide variation in permeability between samples of the same nominal value. Applications of magnetic amplifiers include line-voltage regulation, automatic battery charging, and theatre lighting control.

621.314.3† **315**

Simplified Magnetic Amplifier.—D. A. Bell. (*Wireless Engr*, Sept. 1948, Vol. 25, No. 300, pp. 303–304.) The conventional amplifier using a double-balanced system of four coil units is simplified to a bridged-T form, for applications where proportionality between output and input is unimportant, such as the operation of electromechanical relays. Feedback can be applied from the rectified output to the control circuit or to separate feedback windings ; the amplifier can then discriminate between inputs of different polarity.

621.316.313 **316**

Analyzing Electromagnetic Field Problems.—K. Spangenberg, G. Walters & F. W. Schott. (*Tele-Tech*, Aug. 1948, Vol. 7, No. 8, pp. 22–25, 58.) "The particular network constructed gives solutions of the wave equation in two-dimensional cylindrical coordinates for cases of rotational symmetry, making it possible to determine all of the electrical characteristics of cavity resonators and transmission systems which lie within this category."

621.316.86 **317**

Precision Carbon Resistors.—A. C. Pfister. (*Bell Lab. Rec.*, Oct. 1948, Vol. 26, No. 10, pp. 401–406.) Thin films of carbon are deposited on ceramic cores for resistances of the order 10 kΩ. High resistances are obtained by grinding a helical groove through the carbon film. The perfection and cleanliness of the ceramic surface are most important. See also 318 below.

621.316.86 **318**

High-Frequency Deposited Carbon Resistors.—W. Van Roosbroeck. (*Bell Lab. Rec.*, Oct. 1948, Vol. 26, No. 10, pp. 407–410.) Deposited carbon resistors are useful at h.f. because they have low reactance and constant effective resistance, and there is no skin effect. The resistors should be made as small as is possible without allowing the carbon to reach oxidation temperature. Power dissipation for a given size can be increased by sealing the resistor in an envelope containing a neutral gas, or by liquid cooling. Applications to radar are discussed. See also 317 above.

621.318.4.011.3 : 518.4 **319**

Calculating Mutual Inductance.—R. C. de Holzer. (*Wireless Engr*, Sept. 1948, Vol. 25, No. 300, pp. 286–289.) Formulae and graphs are given for three types of multilayer coils : (*a*) identical coaxial coils, (*b*) different coaxial coils, and (*c*) concentric coplanar coils. Both finite and very small cross-sectional areas are considered. The results are derived from known equations and are sufficiently accurate for most practical cases.

621.318.572 **320**

A New Quenching Circuit for Geiger Counters.—H. Maier-Leibnitz. (*Rev. sci. Instrum.*, Aug. 1948, Vol. 19, No. 8, pp. 500–502.) The quenching circuit operates on the multivibrator principle, but uses two different grids of the input valve for the signal and for the regenerative feedback.

621.319.4 **321**

Oil-Filled Miniature Tuning Capacitors.—S. Wald. (*Tele-Tech*, Oct. 1948, Vol. 7, No. 10, pp. 43–45, 57.) Manufacturing techniques for capacitors designed for high-altitude operation at temperatures from −60° to +85° C. Petroleum naptha was found to give the least variation of capacitance and of Q with temperature. Oil-filled capacitors can be made both smaller and lighter than corresponding air-dielectric capacitors.

621.319.4 : 621.315.612 **322**

Cyclic Variations of Capacitance.—W. Reddish. (*Wireless Engr*, Oct. 1948, Vol. 25, No. 301, pp. 331–337.) The capacitance of a capacitor with titanate ceramic as dielectric varies with temperature and also with the applied voltage. A superposed a.f. alternating voltage is found to cause cyclic in-phase capacitance variations. The a.c. characteristics of such capacitors can be predicted approximately from their d.c. characteristics. Application to f.m. is possible.

621.392 **323**

Analysis of Single-Phase Grid-Controlled Gas-Rectifier Circuits.—C. M. Wallis. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 322–335.) Discussion, with numerical examples, of a method of analysis suitable for cases where the current and voltage waveforms are discontinuous functions of time.

621.392 : 621.396.813 : 621.396.619.13 **324**

The Distortion of Frequency-Modulated Waves by Transmission Networks.—A. S. Gladwin. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, pp. 1257–1259.) Discussion on 1294 of 1948.

621.392 : 621.396.822 **325**

Some Notes on Noise Theory and Its Application to Input Circuit Design.—Harris. (*See* 584.)

621.392.43 **326**

Theoretical Limitations on the Broadband Matching of Arbitrary Impedances.—R. M. Fano. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 109–118.) The general problem of matching an arbitrary load impedance to a pure resistance by means of a reactive network is considered in terms of complex variable theory. Necessary and sufficient conditions are derived for a function of frequency to be realized which represents the input reflection coefficient of the matching network. These conditions lead to a set of integral relations which are used to determine the limitations on bandwidth and matching tolerance. Design curves are obtained for approaching optimum tolerance by means of a finite network, for a particular type of load impedance.

621.396.611 **327**

Mode Separation in Oscillators with Two Coaxial-Line Resonators.—H. J. Reich. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, pp. 1252–1255.) The natural frequencies of a coaxial-line resonator, of characteristic impedance Z_0 and terminated by a capacitance C, can easily be found graphically. The frequencies are not exact multiples of the fundamental. An oscillator using two such resonators can be designed so that oscillation must take place in a chosen mode. Mode separation is favoured by the use of resonators that differ largely in their CZ_0 products. Theoretical and experimental tuning curves for a lighthouse-valve oscillator are in general agreement.

621.396.611 **328**

An Inductance-Capacitance Oscillator of Unusual Frequency Stability.—W. A. Roberts. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, pp. 1261–1262.) Comment on 2193 of 1948 (Clapp).

621.396.611 : 621.316.729 **329**

Pseudosynchronization in Amplitude-Stabilized Oscillators.—D. G. Tucker. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, p. 1262.) Comment on 3044 of 1948 (Aigrain & Williams).

621.396.611 : 621.396.619.13 **330**

Frequency Modulation of an Oscillator.—M. R. Gavin. (*Wireless Engr*, Sept. 1948, Vol. 25, No. 300, pp. 290–293.) A self-oscillatory tuned circuit has another tuned circuit of the same resonant frequency f_0 coupled to it. The frequency f_0 is then unstable for the coupled system, but the secondary series reactance can be adjusted so that the two stable frequencies of this system differ little from f_0. Small modulating variations of this reactance then cause a relatively large degree of f.m. Some a.m. may also occur.

621.396.611 : 621.396.619.13 : 621.384.6 **331**

Wide-Deviation Frequency-Modulated Oscillators.—E. M. Williams & L. Vallese. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, pp. 1282–1284.) Discussion of instantaneous frequency and power relations in these oscillators, with special reference to types used in particle accelerators. There are no fundamental limitations on deviation and modulating frequency in the present range of interest, but a fluctuating load effect arises which may be of importance.

621.396.611.1 : 621.396.621 **332**

Formulas for Image Rejection Calculations.—L. O. Vladimir. (*Tele-Tech*, Oct. 1948, Vol. 7, No. 10, pp. 26–27.) Image rejection is expressed in terms of Q and the ratio γ of the actual frequency to the resonant frequency for 5 types of tuned circuit commonly used in receivers. Equivalent circuits are also shown.

621.396.611.21 **333**

Series-Mode Quartz Crystal Oscillator Circuit.—H. Goldberg & E. L. Crosby, Jr. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 240–250.) Analysis, and discussion of modifications, of a circuit proposed by Butler (32 of 1945). See also 3048 of 1948.

621.396.615 **334**

Valve Oscillator Circuits.—E. Williams. (*Wireless Engr*, Sept. 1948, Vol. 25, No. 300, pp. 297–300.) Oscillators of the feedback type are considered as particular cases of a basic circuit and classified as (*a*) phase-restored circuits, (*b*) zero-phase-shift circuits, (*c*) tapped resonant circuits.

621.396.615 **335**

The Tapered Phase-Shift Oscillator.—P. G. Sulzer. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, pp. 1302–1305.) Feedback is obtained by means of T sections in cascade, the sections comprising series-C and shunt-R elements, or vice versa. The values of the series-C elements are progressively decreased by a factor a, while the shunt-R elements are increased by the same factor to obtain less attenuation for the same phase-shift. The performance of a.f. oscillators of this type is shown for varied heater and anode voltages.

621.396.615 : 621.316.726 **336**

Semigraphical Analysis of Oscillator Frequency Instability.—F. P. Fischer. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, p. 662.) Summary only. A method is described for determining the equilibrium conditions for certain types of valve oscillator. It is possible to observe the effects of altering the controlling parameters and thus to solve problems of stabilization.

621.396.615.14 + 621.396.645 **337**

V.H.F. Valves and Circuits.—M. R. Gavin. (*Wireless Engr*, Oct. 1948, Vol. 25, No. 301, pp. 315–321.) The use of negative-grid valves as oscillators and amplifiers is discussed. Improvement in performance can be obtained by adapting the valves to the circuits in which they operate, and particularly by making the valves integral parts of concentric-line circuits. Examples of this procedure are given and possible future developments are indicated. See also 683 of 1948 (Bell, Gavin, James & Warren).

621.396.615.14 : 621.385.3 **338**

Triodes for Very Short Waves — Oscillators.—J. Bell, M. R. Gavin, E. G. James & G. W. Warren. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, p. 414.) Discussion on 683 of 1948.

621.396.615.142 **339**

A Velocity-Modulation Reflection Oscillator for Wavelengths of about 3.2 cm.—A. F. Pearce. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 415–422; summary *ibid.*, Part I, Sept. 1948, Vol. 95, No. 93, pp. 403–404.) A harmonic resonator is used in conjunction with disk-seal construction. Tuning is effected by flexure of one of the resonator diaphragms. The average power output is over 100 mW. Characteristics and dimension details are given. Performance is discussed in relation to the theory of Barford & Manifold (894 of 1948).

621.396.615.17 **340**

Low-Power Frequency Multipliers.—R. J. Schwarz. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 220–239.) A frequency f is fed into the grid of a class-C pentode amplifier whose anode circuit is tuned to a harmonic *nf*. Expressions are derived relating the input voltage to the harmonic output voltage for linear and square-law characteristics and for both fixed and grid-leak bias. Experiments confirm the analytical results.

621.396.619.14 **341**

Phase Modulation Circuit.—S. M. Beleskas. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 654–661.) An arrangement for ph.m. up to ±90°, with not more than 10% distortion.

621.396.619.23 **342**

Serrasoid F.M. Modulator.—J. R. Day. (*Electronics*, Oct. 1948, Vol. 21, No. 10, pp. 72–76.) A phase-shift type of frequency modulator which produces 100% modulation, with noise 80 db down and 0.25% harmonic distortion in broadcast service. A linear sawtooth generator is triggered by short rectangular pulses spaced 10 μs apart. These are derived from a crystal-controlled 100-kc/s oscillator. The sawtooth generator is directly coupled to the grid of the modulator valve, which is biased so that conduction begins when the sawtooth voltage has risen to half its maximum value. A pulse of anode current flows during the latter half of the sawtooth wave and if the modulator bias is varied, the leading edge of the pulse will vary in phase. Audio signals, fed through a conventional phase-corrector network, vary the bias, and so modulate the phase of the output pulse. This pulse, after frequency multiplication by 972, yields a carrier of 97.2 Mc/s, with a deviation of ±75 kc/s at 100% modulation. The circuits are discussed in detail, and well illustrated by means of circuit diagrams and waveforms. For another account see *Tele-Tech*, Oct. 1948, Vol. 7, No. 10, p. 39.

621.396.619.23 : 621.396.931 **343**

The Miller F.M. Circuit and its Use in Railroad Radios.—P. L. Bargellini. (*Electronics*, Oct. 1948, Vol. 21, No. 10, pp. 130..190.) The tuned circuit of a Hartley oscillator is connected between the modulator grid and earth. Variation of input capacitance of the modulator is achieved by using for anode load a triode whose resistance depends on the a.f. signal voltage. This type of modulator has given satisfactory results in equipment built for the Italian State railways.

621.396.645 **344**

Amplitude-Selective Amplifier.—C. E. Lowe. (*Electronics*, Oct. 1948, Vol. 21, No. 10, pp. 156..184.) Circuit devised to improve a servo-system which operates a drag-cup motor in response to the output signal of a magnetic bridge. This signal is amplified and the fundamental frequency is separated from the envelope of the second harmonic. The motor-operating sine-wave output remains almost constant in frequency up to the point of complete bridge balance, when its frequency rapidly changes to the second harmonic of the bridge excitation frequency. Essential features of the circuit are cascaded discriminators, followed by a pulse reshaper.

621.396.645 **345**

Some Considerations concerning Cathode-Tapped Cathode-Followers.—B. B. Underhill. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, p. 219.) Summary only. If the grid of a cathode follower is returned to a tap on the cathode resistor instead of to ground, the output admittance of the cathode follower differs from the transconductance of the valve. The difference includes terms depending on the impedance of the source to which the cathode follower is connected, the valve parameters, and the fraction of the cathode resistance included in the grid return circuit. Graphs illustrate the effect of variations of the cathode tap on various circuit quantities. Simplifying assumptions are made which usually apply in practice.

621.396.645.371 **346**

Dynamic Impedance Circuit.—Y. P. Yu. (*Tele-Tech*, Aug. 1948, Vol. 7, No. 8, pp. 28–29..57.) Discussion of a negative-feedback amplifier whose effective input impedance may be made resistive or reactive and varied linearly by a factor of about 10 in response to an external control voltage. Applications suggested include filters with variable cut-off frequency, and wide-band frequency modulators.

621.396.645.371 **347**

The Miller Integrator.—B. H. Briggs. (*Electronic Engng*, Aug.–Oct. 1948, Vol. 20, Nos. 246–248, pp. 243–247, 279–284 & 325–330.) The basic principles of the integrator are discussed, with particular reference to the production of a potential variation which is linear with time. The extent of the departures from linearity which may be expected with this type of circuit is considered for different anode loads, consisting of (*a*) resistance and capacitance in parallel, (*b*) resistance and inductance in series, and (*c*) inductance and capacitance in parallel. The action of various special circuits, including the sanatron and the phantastron, is explained and applications to the generation of special waveforms and to electronic calculators are discussed briefly.

621.396.662.029.64 **348**

A Bead Supported Coaxial Attenuator for the Frequency Band 4 000-10 000 Mc/s.—H. J. Carlin & J. W. E. Griemsmann. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 79–89.) A metallized resistance film on glass tubing is used for the inner conductor. Special couplings and grooved-bead supports allow the units to terminate in Type-N fittings without introducing much reflection.

621.396.662.3 : 537.228.1 **349**

Single-Sideband Crystal Filters.—P. K. Taylor. (*Electronics*, Oct. 1948, Vol. 21, No. 10, pp. 116–120.) X-cut crystals are used in multi-section filters for the upper and lower sidebands and for the carrier frequency. The sideband filter response is flat within 0.6 db for nearly 6 kc/s, and the carrier filter has a bandwidth of 16 c/s at the 3-db point. The temperature/attenuation characteristic shows an average shift of 0.44 c/s per degree. Circuit diagrams of the filters are given.

621.396.662.3.015.3 **350**

Network Transients.—E. V. D. Glazier. (*Wireless Engr*, Oct. 1948, Vol. 25, No. 301, pp. 338–339.) Application of the late A. W. Glazier's theory (1611 of 1948) to symmetrical constant-resistance types of network. Two examples are discussed, one being the low-pass filter described by Simmonds & Roberts (1430 of 1945).

621.396.665 : 621.397.62 **351**

Automatic Gain Controls for Television Receivers: Part 1 — General Considerations.—K. R. Wendt & A. C. Schroeder. (*RCA Rev.*, Sept. 1948, Vol. 9, No. 3, pp. 373–385.) The use of a.g.c. is outlined and factors limiting the operation of various types of circuit are discussed. Several early types of a.g.c. circuits are described, with circuit diagrams illustrating the development of rapidly-operating controls with improved noise immunity. Great improvement in noise immunity is obtained by using circuits which only operate during a keying pulse occurring within the signal synchronizing pulse. Part 2, 352 below.

621.396.665 : 621.397.62 **352**

Automatic Gain Controls for Television Receivers : Part 2 — A New Fast Noise-Immune Television A.G.C. Circuit.—K. R. Wendt. (*RCA Rev.*, Sept. 1948, Vol. 9, No. 3, pp. 385–393.) Description and diagram of an 'inverted keying' circuit, in which response to noise impulses is slow and recovery rapid. This circuit responds more rapidly to a decreased than to an increased signal. Part 1, 351 above.

621.396.69 **353**

Radio Components.—(*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 938–942.) Discussion on 1895 of 1948 (Lee) and on 1900 of 1948 (Ross).

621.318.572.029.64 **354**

Microwave Duplexers. [Book Review]—L. D. Smullin & C. G. Montgomery (Eds). McGraw-Hill, London, 437 pp., 39s. (*Wireless Engr*, Sept. 1948, Vol. 25, No. 300, p. 302.) No. 14 of the M.I.T. Radiation Laboratory series. The book combines "a mass of important empirical data, a valiant attempt at a theory of the gaseous discharge, and much detailed circuit analysis." It is mainly concerned with t.r. and a.t.r. switches, discovered in their modern form at the Telecommunications Research Establishment.

621.392 : 621.385 **355**

Vacuum Tube Circuits. [Book Review]—L. B. Arguimbau. J. Wiley, New York, 1948, 657 pp., $6.00. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, p. 1272.) "On the whole, this is an excellent reference book on the design of vacuum-tube circuits . . . It could be very useful in teaching a design course to those who have already had a basic course."

GENERAL PHYSICS

53.081 + 621.3.081 **356**

The Origin of the Giorgi System of Electrical Units.—W. de Groot. (*Philips tech. Rev.*, Aug. 1948, Vol. 10, No. 2, pp. 55–60.)

537.291 **357**

Plotting Electron Paths.—P. J. Selgin. (*Electronics*, Sept. 1948, Vol. 21, No. 9, pp. 124..166.) A method using a universal set of curves developed on the assumption that the electron trajectory between equipotentials is an arc of a parabola.

537.311.33 : 621.396.645 : 621.315.59 **358**

Design of Amplifying Crystal Units.—White. (*See* 581.)

537.311.33 : 621.396.645 : 621.315.59 **359**

Experimental Data on Germanium Crystal Amplifiers.—White. (*See* 582.)

537.311.62 **360**

The High-Frequency Skin Effect at Low Temperatures.—A. B. Pippard. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, p. 343. Discussion, pp. 343–345.) Summary of I.E.E. Scientific Radio Convention paper. At low temperatures ($\rightarrow 2^\circ$K) the surface resistivity of a metal tends to a constant value instead of a value inversely proportional to the square root of the bulk conductivity. This is due to the long free paths of the conduction electrons.

537.523 **361**

High-Frequency Electrical Breakdown Phenomena in Gases.—R. Cooper & W. A. Prowse. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, p. 342. Discussion, pp. 343–345.) Summary of I.E.E. Scientific Radio Convention paper. For frequencies below a critical value, the breakdown stress of air agrees with the 50-c/s value. At higher frequencies it falls quickly to a value of about 28 kV/cm. A true minimum stress for breakdown exists at frequencies in the range 2 800–9 800 Mc/s. Methods of measurement and the form of the discharge are discussed.

537.525 **362**

Studies in High Frequency Discharges.—J. I. Lodge & R. W. Stewart. (*Canad. J. Res.*, July 1948, Vol. 26, Sec. A, No. 4, pp. 205–229.) Theoretical discussion, assuming that the discharge is largely determined by its d.c. wall and space charges, and that the chief function of the h.f. field is to maintain the electron temperature.

537.525.3(23.084) : 621.396.933 **363**

Corona Discharge at High Altitude and its Control to Reduce Radio Interference.—H. J. Dana. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 40–46.) The causes of interference with radio navigation aids and the basic laws of corona discharge are discussed. Measurement apparatus and methods are considered and results of tests are examined in detail.

538.22 **364**

Investigations of Magnetic Phenomena at Centimetre Wavelengths.—J. H. E. Griffiths. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 342–343. Discussion, pp. 343–345.) Summary of I.E.E. Scientific Radio Convention paper. Discussion of : (*a*) complex permeability of γFe_2O_3 for λ 3–60 cm, (*b*) ferromagnetic resonance, and (*c*) resonance absorption by paramagnetic salts.

538.31 **365**

On the Mutual Magnetic Energy of a Current and a Magnet.—É. Brylinski. (*Rev. gén. Élect.*, Aug. 1948, Vol. 57, No. 8, pp. 340–345.) Discussion of the two cases where the elements are free to move and where they are relatively at rest. It is concluded that this magnetic energy should not enter into the expression for the total magnetic energy of the system.

538.569.3/.4].029.64 **366**

High-Frequency Absorption Phenomena in Liquids and Solids.—W. Jackson & J. A. Saxton. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 341–342. Discussion, pp. 343–345.) Summary of I.E.E. Scientific Radio Convention paper. A review of recent work by various authors.

538.569.4.029.64 **367**

Microwave Spectroscopy of Gases.—B. Bleaney. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 340-341. Discussion, pp. 343-345.) Summary of I.E.E. Scientific Radio Convention paper. Discussion of : (*a*) methods of measuring cm-λ absorption, (*b*) theoretical and experimental absorption spectra for NH_3 and for atmospheric gases. See also 3100 and 3397 of 1948 and back references.

53 **368**

Reports on Progress in Physics. Vol. 11, 1946-47. [Book Review]—The Physical Society, London, 461 pp., 42s. (*Wireless Engr*, Oct. 1948, Vol. 25, No. 301, p. 321.) Titles of selected papers are quoted. For abstracts of individual papers, see 3300, 3395, 3401, 3402, 3473 and 3483 of 1948.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.53 : 551.510.535 : 621.396.11.029.62 **369**

Reflection of Very-High-Frequency Radio Waves from Meteoric Ionization.—E. W. Allen, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, pp. 1255–1257.) Discussion on 2328 of 1948.

523.53 : 621.396.9 **370**

Meteors and Their Effect on Radio.—A. C. B. Lovell. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 324–325. Discussion, pp. 327–330.) Summary of I.E.E. Scientific Radio Convention paper. Discussion of: (*a*) scattering as a function of wavelength, (*b*) number and duration of echoes, (*c*) fluctuations in intensity, (*d*) diffraction effects, and (*e*) sporadic-E ionization.

523.7 + 550.385] " 1947.10/.12 " **371**

Solar and Magnetic Data October to December, 1947, Mount Wilson Observatory.—S. B. Nicholson. (*Terr. Magn. atmos. Elect.*, March 1948, Vol. 53, No. 1, p. 26.)

523.72 + 523.854] : 621.396.822 **372**

Galactic and Solar Radio Noise.—J. S. Hey. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, p. 333. Discussion, pp. 334–340.) Summary of I.E.E. Scientific Radio Convention paper. The high-intensity r.f. emission from sunspots, which is particularly strong for $\lambda \approx 5$ m, suggests that stars may have similar spots which cause galactic noise. Movements of electrons in inter-stellar ionized gas may be an additional contributory cause.

523.72.029.62 **373**

Some Observations of Solar Radiation on Wavelengths of 1.7 and 3.8 Metres.—M. Ryle. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 333–334. Discussion, pp. 334–340.) Summary of I.E.E. Scientific Radio Convention paper. In the absence of sunspots the sun radiates with an intensity corresponding to a surface temperature of about 10^6 °K. Sunspot areas radiate as if they were at a temperature of 10^9–10^{10} °K. Bursts of intense radiation do not occur simultaneously on the two above wavelengths. Radiation from the undisturbed sun is randomly polarized. Radiation from sunspots is usually circularly polarized in a sense determined by the direction of the magnetic field of the sunspot.

523.72.029.63 : 621.396.822 **374**

Solar Radio Noise.—(*Observatory*, Oct. 1948, Vol. 68, No. 846, pp. 178–183.) Summary of Royal Astronomical Society Discussion. The unexpectedly high intensity of 1–5-m radiation from the quiescent sun can be explained on thermodynamical grounds. Attempts were made to explain similarly the much more intense radiation from sunspots. The possibility that plasma oscillations might be the effective cause was also considered, and suggestions for further research were made.

523.746 " 1947.10/.12 " **375**

Provisional Sunspot-Numbers for October to December, 1947.—M. Waldmeier. (*Terr. Magn. atmos. Elect.*, March 1948, Vol. 53, No. 1, p. 34.)

523.752 **376**

Chromospheric Flares.—R. G. Giovanelli. (*Mon. Not. R. astr. Soc.*, 1948, Vol. 108, No. 2, pp. 163–176.) A brief account of the observed properties. The flares may be caused by variations in the magnetic flux through a nearby sunspot. If the electric field exceeds a certain value, electrons acquire sufficient energy to excite H atoms by collision and flares may result. The flares should occur in definite places depending largely on the shape of the magnetic field in the neighbourhood of sunspot groups. Most of the well-known features of flares are explained by this theory.

523.854 : 621.396.822 **377**

Cosmic Static.—G. Reber. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, pp. 1215–1218.) The results of a survey of the galaxy made at a frequency of 480 Mc/s are compared with previous results for 160 Mc/s given in 1028 of 1945. The apparatus used is briefly described. The principal new findings are: (*a*) a projection from Sagittarius in the direction of the north galactic pole; (*b*) a supplementary small rise in Aquila; and (*c*) a splitting of the maxima in Cygnus and Orion each into two parts.

550.38 " 1947.10/.12 " **378**

K-Indices and Sudden Commencements, October to December, 1947, at Abinger.—H. Spencer Jones. (*Terr. Magn. atmos. Elect.*, March 1948, Vol. 53, No. 1, p. 78.)

550.38 " 1947.10/.12 " **379**

Cheltenham [Maryland] ***K*-Indices for October to December, 1947.**—R. G. Gebhardt. (*Terr. Magn. atmos. Elect.*, March 1948, Vol. 53, No. 1, p. 81.)

550.383 **380**

The Radial Variation of the Earth's Magnetic Field.—S. K. Runcorn : S. Chapman. (*Proc. phys. Soc.*, 1st Oct. 1948, Vol. 61, No. 346, pp. 373–382.) Core and distributed theories of geomagnetism predict different variations of field intensity with depth d. Core theories give an increase of both H and V inversely proportional to d^3, but on a distributed theory such as that of Blackett (3112 of 1947), V should increase for small depths inversely as d^3, while H should decrease. If experiments on the variations with depth favour the distributed theories, experiments on the magnetic effect of gorges on the earth's surface might further elucidate the problem.

550.384.3 **381**

The Secular Change in the Earth's Magnetic Field.—E. C. Bullard. (*Mon. Not. R. astr. Soc., Geophys. Supplement*, July 1948, Vol. 5, No. 7, pp. 248–257.) A theoretical discussion attempting to explain the known facts. Causes situated in the solid outer skin of the earth are ruled out. A possible explanation is the existence of shallow eddies in the liquid core, which is assumed to be composed of Fe and Ni in the proportions commonly found in meteorites, but the required speed of movement in the eddy seems unduly high. Further investigation, both theoretical and experimental, is required.

550.385 " 1947.10/.12 " **382**

Principal Magnetic Storms [Oct.–Dec. 1947].—(*Terr. Magn. atmos. Elect.*, March 1948, Vol. 53, No. 1, pp. 84–95.)

550.385 " 1947.01/.06 " **383**

Five International Quiet and Disturbed Days for January to June, 1947.—W. E. Scott. (*Terr. Magn. atmos. Elect.*, March 1948, Vol. 53, No. 1, p. 66.)

550.387 **384**

The Magnetic Field Produced by Earth Currents flowing in an Estuary or Sea Channel.—N. F. Barber. (*Mon. Not. R. astr. Soc., Geophys. Supplement*, July 1948, Vol. 5, No. 7, pp. 258–269.) Measurements in the Clyde estuary of fluctuations of the earth's vertical magnetic field, and of simultaneous fluctuations in the horizontal potential gradients in the water, show definite correlation. Similar results were obtained by Hoare and Rowe in Iceland. A large proportion of the short-period fluctuations of vertical intensity recorded at the magnetic observatory at Abinger can be ascribed to variations in the earth current in the English Channel.

551.509 : 621.396.9 **385**

Radar and the Forecaster.—P. F. Duncan. (*Weather, Lond.*, Feb. 1948, Vol. 3, No. 2, pp. 34–36.) Discussion of the use of radar for obtaining information about clouds, rain, thunderstorms, etc., for weather forecasting.

551.510.535 **386**

A Model of the Ionosphere.—R. H. Woodward. (*Terr. Magn. atmos. Elect.*, March 1948, Vol. 53, No. 1, pp. 1–25.) A brief survey is made of the main geophysical phenomena. Qualitative explanation of these phenomena is provided by a model which assumes an upward flow of electrons in low and in medium latitudes and a corresponding downward flow in polar regions, the circuit being completed by the earth and the ionosphere. The combined action of electric and magnetic fields results in negative-ion concentration at the poles and a positive-ion ring around the geomagnetic equator. Solar radiation pressure produces marked distortion of this ring. Electric discharges between the ring and the negative polar caps produce magnetic disturbances and the associated auroral displays.

551.510.535 **387**

On a New Method for Exploring the Upper Ionosphere.—D. K. Bailey. (*Terr. Magn. atmos. Elect.*, March 1948, Vol. 53, No. 1, pp. 41–50.) The intensity of ionization in the region above the height of maximum F_2-layer ionization is not known, but some information can be obtained by measuring the refraction of radio waves arriving at the earth after passage through the entire ionosphere. An experimental technique for such measurement is discussed. A theoretical expression is derived for the refraction of radio waves which pass through a parabolic-layer model; the range of frequencies within which refraction measurements should be made is deduced. Extraterrestrial radio waves can be obtained either from the sun or by reflection from the moon.

551.510.535 **388**

The Production of the E-Layer.—F. Hoyle & D. R. Bates. (*Terr. Magn. atmos. Elect.*, March 1948, Vol. 53, No. 1, pp. 51–62.) Difficulties in the current theory of E-layer formation are summarized. An alternative suggestion is that the layer is produced by high-energy photons from the solar corona. An incident energy flux with maximum around either 325 eV or 1 300 eV could give the observed ionization, but only the former value would be fully satisfactory.

551.510.535 **389**

The Geomagnetic Nature of the F_2-Layer Longitude-Effect.—D. K. Bailey. (*Terr. Magn. atmos. Elect.*, March 1948, Vol. 53, No. 1, pp. 35–39.)

551.510.535 **390**

A Sporadic F-Layer.—O. Burkard. (*Terr. Magn. atmos. Elect.*, March 1948, Vol. 53, No. 1, pp. 63–65.) Results of observations at Tromsö, Norway, on a night-time sporadic-F layer, during the winter of 1944/1945.

551.510.535 : 523.746 **391**

Comparative Correlations of $f^{\circ}F_2$ with "Ionospheric Sunspot-Number" and Ordinary Sunspot-Number.—M. L. Phillips. (*Terr. Magn. atmos. Elect.*, March 1948, Vol. 53, No. 1, pp. 79–80.) See also 727 of 1948.

551.515.4 : 621.396.9 **392**

A Summary of some Radar Thunderstorm Observations.—H. B. Brooks. (*Bull. Amer. met. Soc.*, Dec. 1946, Vol. 27, No. 10, pp. 557–563.) Statistics of 300 showers observed at Spring Lake, N.J., during June–Aug. 1945.

551.577 : 621.396.9 **393**

Radar Detection of Precipitation.—A. E. Bent. (*Weather, Lond.*, Feb. 1948, Vol. 3, No. 2, pp. 37–41.) Reprint of major portion of article in *J. Met.*, Sept. 1946, Vol. 3, No. 3. An account of results obtained with 10-cm equipment, using a p.p.i. display.

551.594.2 **394**

Atmospheric Electricity during Disturbed Weather.—G. C. Simpson. (*Terr. Magn. atmos. Elect.*, March 1948, Vol. 53, No. 1, pp. 27–33.) Long summary of a paper to be published by the London Meteorological Office as Geophysical Memoir No. 84, dealing with a special investigation at Kew Observatory from Oct. 1942 to May 1946, which included observations of the potential gradient and of the charge carried by rain and snow.

551.594.6 **395**

Atmospherics.—T. W. Wormell & E. T. Pierce. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 331–332. Discussion, pp. 334–340.) Summary of I.E.E. Scientific Radio Convention paper. An account of investigations of (*a*) the effects of lightning flashes at distances up to about 100 km, (*b*) the detailed waveform of the field disturbance due to flashes at much greater distances.

551.594.6 : 621.396.822 **396**

The World Distribution of Radio Noise.—H. A. Thomas. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 332–333. Discussion, pp. 334–340.) Summary of I.E.E. Scientific Radio Convention paper. Measurements have been made hourly for nearly 3 years at each of 14 stations, at frequencies of 2.5, 5, 10, 15 and 20 Mc/s. The median noise characteristic for a particular location has a very real significance, but does not appear to apply to a large area. The incomplete results suggest that the sources of atmospherics may be local.

551.510.535 **397**

Ionospheric Research at Watheroo Observatory, Western Australia, June 1938 - June 1946. [Book Review]—L. V. Berkner & H. W. Wells. Carnegie Institution of Washington, Publication 175, Vol. 13, 1948, 421 pp. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, p. 1272.) A repository of data, with an introductory text giving a concise account of methods of ionospheric research. See also 2795 of 1948 (Seaton, Wells & Berkner).

LOCATION AND AIDS TO NAVIGATION

621.396.9 **398**

Minimum Detectable Radar Signal.—U. Tiberio. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, p. 1261.) Comment on 1095 of 1947 (Haeff).

621.396.9 **399**

Some Applications of Frequency-Modulated Radar.—I. Wolff & D. G. C. Luck. (*RCA Rev.*, Sept. 1948, Vol. 9, No. 3, pp. 531–555.) Continuation of 2798 and 3124 of 1948. The principles there discussed are applied to the production of light, compact f.m. radar for aircraft. A f.m. radar system is particularly suitable for operating a low-altitude automatic bomb release. Other applications include altimetry, automatic flight control, control of aircraft landing approach, and radar search.

621.396.9 : 621.385.832 **400**

Three-Dimensional Cathode-Ray Tube Displays.—Parker & Wallis. (*See* 577).

621.396.933 **401**

Functional Requirements for Radio Aids to Civil Aviation.—V. A. M. Hunt. (*J. Brit. Instn Radio Engrs*, March/April 1948, Vol. 8, No. 2, pp. 41–56. Discussion, pp. 56–60.) Discussion with special reference to the conclusions reached by the Special Radio Technical or ‘ Cot ’ Division of P.I.C.A.O. at the Montreal conference, November 1946. Reprinted in *Proc. Instn Radio Engrs, Aust.*, Sept. 1947, Vol. 8, No. 9, pp. 16–25.

621.396.933 **402**

C.W. Navigational Aids.—(*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 1022–1030.) Discussion on 1958 of 1948 (Whelpton & Redgment) and on 1960 of 1948 (Williams).

621.396.933 **403**

The Application of Existing Techniques to the Problem of Air Traffic Control.—W. D. White. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 468–479.)

621.396.933 **404**

Teleran — A Technical Progress Report.—R. W. K. Smith, D. H. Ewing & H. J. Schrader. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 429–448.)

621.396.933 : 518.5 **405**

Computer for Aeronautical Navigation.—Schuck. (*See* 422.)

621.396.933 : 537.525.3(23.084) **406**

Corona Discharge at High Altitude and its Control to Reduce Radio Interference.—Dana. (*See* 363.)

621.396.9 **407**

Radar ; What Radar Is and How It Works. [Book Review]—O. E. Dunlap, Jr. Harper Bros, New York, 2nd edn 1948, 246 pp., $3.00. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, p. 1272.) The second edition of a book noted in 2201 of 1946 under the title ‘ Radar . A sensational account of what radar has done, containing thought-provoking suggestion of what radar might do. See also 2134 of 1947 (Rider & Rowe).

MATERIALS AND SUBSIDIARY TECHNIQUES

533.15 **408**

A Mass-Spectrometer Type Leak Detector utilizing a Cold Cathode Ion Source.—H. A. Thomas, H. Sommer & R. Wall. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 371–376.) This is simpler and cheaper than the hot-cathode type. 1 part of He in 400 000 parts of air can be detected with laboratory-type instruments.

533.5 **409**

Vacuum Systems, Seals, and Valves.—F. N. D. Kurie. (*Rev. sci. Instrum.*, Aug. 1948, Vol. 19, No. 8, pp. 485–493.) Discussion of all-metal, kinetic vacuum systems designed to operate at pressures down to 10^{-5} mm Hg, and of precautions necessary in assembling and maintaining such systems. Reliable, high-speed valves are needed. Rubber gaskets are considered in detail, and the usefulness of O-rings is also noted, with specific examples.

535.371.07 : 621.317.755 **410**

Luminescent Screens for Cathode-Ray Oscillography.—Feldt. (*See* 445.)

549.514.51 **411**

Synthetic Crystals of Quartz.—(*Bell Lab. Rec.*, Sept. 1948, Vol. 26, No. 9, pp. 384–385.) Summary of paper by E. Buehler & A. C. Walker read at a meeting of the International Union of Crystallography. Finely powdered silica is placed in a steel bomb with an aqueous alkaline solution. Under pressures above 15 000 lb/inch² and at a temperature of about 750°F the silica dissolves, rises to the cooler part of the bomb, and crystallizes on a thin seed-plate of quartz. The standard growth rate is stated to be four times as fast as any previously reported.

549.514.51 **412**

The Effect of Spurious Resonances and Parallel Losses on the Equivalent Parameters of Quartz Crystals.—B. A. Mamyrin & L. N. Sosnovkin. (*Zh. tekh. Fiz.*, July 1948, Vol. 18, No. 7, pp. 955–958. In Russian.) A report of an experimental investigation of quartz crystals manufactured in Russia, Germany and the U.S.A. Results are tabulated.

621.315.59 **413**

Electrical Semi-Conductors.—K. Lark-Horovitz. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, p. 524.) Summary only. Discussion of the electrical behaviour of metals, insulators and semiconductors, with experimental verification of theory for Ge with various types of impurity. Applications are also considered.

621.315.612 **414**

Properties of Barium-Magnesium Titanate Dielectrics.—G. R. Shelton, A. S. Creamer & E. N. Bunting. (*Bur. Stand. J. Res.*, July 1948, Vol. 41, No. 1, pp. 17–26.) Results are given of measurements on samples of various compositions (*a*) for dielectric constant K at 1 Mc/s and temperature from $-60°$ to $+85°$C, (*b*) for Q, the reciprocal of power factor, at 25°C and frequencies of 50 kc/s and 1, 20 and 3 000 Mc/s. K values ranged from 12 to 1 550 and those of Q from 9 to 10 000.

621.315.612 : 621.319.4 **415**

Cyclic Variations of Capacitance.—Reddish. (*See* 322.)

MATHEMATICS

517.564.3 : [621.392.26† + 621.396.611.4 **416**

Some Bessel Equations and their Application to Guide and Cavity Theory.—M. Kline. (*J. Math. Phys.*, April 1948, Vol. 27, No. 1, pp. 37–48.) Discussion of the real positive values of x which satisfy either

$$J_n(x)N_n(\rho x)-J_n(\rho x)N_n(x) = 0, \text{ or}$$
$$J'_n(x)N'_n(\rho x) - J'_n(\rho x)N'_n(x) = 0,$$

where $0<\rho<1$, $n = 0, 1, 2, 3, \ldots$ and $J_n(x)$, $N_n(x)$ are Bessel functions of the first and second kinds. The existence of e.m. modes in coaxial, circularly cylindrical waveguides and cavities depends upon the existence of such values of x. See also 417 below.

517.564.3 : 621.392.26† **417**

Table of Roots for Natural Frequencies in Coaxial Type Cavities.—H. B. Dwight. (*J. Math. Phys.*, April 1948, Vol. 27, No. 1, pp. 84–89.) Numerical values of the smaller roots of the equations discussed in 416 above, for various values of ρ from 1 upwards.

518.5 **418**

Digital Computer Switching Circuits.—C. H. Page. (*Electronics*, Sept. 1948, Vol. 21, No. 9, pp. 110–118.) An account of the fundamental principles of digital computers and the basic operational requirements. Methods of representing, transmitting and storing numbers and orders as trains of pulses at a repetition rate of 2×10^6 per sec are described. The operation of an elementary adder and the functions of gates and buffers are discussed, and also serial adding circuits using diodes for coding and decoding orders.

518.5 **419**

Electronic Computers.—J. W. Mauchly & J. P. Eckert, Jr. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, p. 200.) 2-line summary only. Discusses Edvac and other types.

518.5 : 512.25 **420**

Details of the Simultaneous Equation Solver.—E. A. Goldberg. (*RCA Rev.*, Sept. 1948, Vol. 9, No. 3, pp. 394–405.) The electrical design and operation of a practical model for solving systems of up to 10 linear simultaneous equations are considered in detail. Stability is considered by E. A. Goldberg & G. W. Brown in *J. appl. Phys.*, April 1948, Vol. 19, No. 4, pp. 339–345.

518.5 : 621.395.625.3 **421**

Storage of Numbers on Magnetic Tape.—J. M. Coombs. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 201–209.) The tapes are bonded to the surface of an Al drum. Associated with each tape are 3 heads for reading, writing and erasing magnetized spots on the tapes. 200 000 magnetized spots can be stored on a drum 34 inches in diameter and 10 inches wide.

518.5 : 621.396.933 **422**

Computer for Aeronautical Navigation.—O. H. Schuck. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 210–218.) By electrical means, bearing and distance from a radio beacon are converted to distance from destination and distance off track. Aircraft are thus enabled to fly on parallel paths.

51 : 621.396 **423**

Basic Mathematics for Radio. [Book Review]—G. F. Maedel. Prentice-Hall, New York, 1948, 334 pp., $4.75. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, p. 1269.) An earlier edition (with a different title) was noted in 3383 of 1939.

518.5 + 621.317.7 + 621-526 + 621.316.72 **424**

Electronic Instruments. [Book Review]—Greenwood, Holdam & MacRae. (*See* 454.)

MEASUREMENTS AND TEST GEAR

621.317.083.7 : 623.746.48 **425**

Telemetry for Guided Missiles.—L. J. Neelands & W. Hausz. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 404–416.) A mechanical commutator samples each of 28 channels 35 times per sec; the information is transmitted to a ground station, where it is displayed on a c.r. tube and photographed.

621.317.3.029.5/.62 **426**

An Appraisal of Laboratory Radio Measuring Techniques: Part 1 — Frequencies below 300 Mc/s.—T. I. Jones. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 315–316. Discussion, pp. 318–324.) Summary of I.E.E. Scientific Radio Convention paper. Methods of calibration and accuracies obtainable for voltmeters, ammeters, attenuators and impedance meters are discussed.

621.317.3.029.63/.64 **427**

An Appraisal of Laboratory Radio Measuring Techniques: Part 2 — Frequencies above 300 Mc/s.—F. M. Colebrook. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, p. 316. Discussion, pp. 318–324.) Summary of I.E.E. Scientific Radio Convention paper. Power measurement technique is now substantially as described by Oatley (1988 of 1948). Both resonance and standing-wave methods of impedance measurement are considered.

621.317.32 **428**

Radio Field-Strength Measurement.—R. L. Smith-Rose. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 317–318. Discussion, pp. 318–324.) Summary of I.E.E. Scientific Radio Convention paper. A survey of present techniques and attainable accuracies. Above 30 Mc/s the main recent improvements have been due to (*a*) the separation of the calibrating unit from the field-strength measuring set, and its replacement by a method of producing a known field by radiation, and (*b*) replacement of current or voltage measurement by power measurement.

621.317.32 **429**

A Method of Measuring the Field Strength of High-Frequency Electromagnetic Fields.—R. Truell. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, pp. 1249–1251.) Discussion of the case of an electron beam directed parallel to a uniform steady magnetic field and perpendicular to a h.f. e.m. field. The equations of motion simplify if $eH_z/mc = \omega$, where ω is the frequency of the e.m. field. This relation can be used to measure the strength of the h.f. field.

621.317.333.4 : 621.315.2 **430**

Various Papers on Investigation of Faults in Cables.—(*See* 280–283 and 286–289.)

621.317.333.4 : 621.315.212 **431**

Test Sets for Dielectric Faults in Coaxial Cable.—J. W. Kittner, Jr. (*Bell Lab. Rec.*, Oct. 1948, Vol. 26, No. 10, pp. 416–420.) The 'Sliver Burner' 94A test set burns out low-resistance dielectric faults electrically. The 90A test set locates by a bridge method those faults which cannot be burnt out.

621.317.336 **432**

A Null-Method for the Determination of Impedance in the 100-400 Mc/s Range.—J. F. Byrne. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 603–614.) The unknown impedance is connected to a branched transmission line and the phase and amplitude of the current through it are determined independently in a bridge type of equipment including a double section of slotted line. The method is quick and its accuracy is within 3° and 5% over the frequency band tested, 130–220 Mc/s.

621.317.361 **433**

Frequency Measurement by Sliding Harmonics.—J. K. Clapp. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, pp. 1285–1288.) The output of a 950-kc/s crystal oscillator is mixed with that of a 50–60-kc/s accurately calibrated bridge oscillator to produce a standard frequency variable between 1 000 and 1 010 kc/s, which drives a harmonic generator. Methods of extending the range of a given standard are discussed. Accuracy is within 1 part in 10^5.

621.317.373 **434**

The Accurate Measurement of Relative Phase.—R. A. Glaser. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 593–602.) Direct phase-difference measurement is frequently carried out by observing the characteristics of the Lissajous figure (ellipse) traced on a c.r.o. when the two signals are applied to the two sets of deflecting plates. The accuracy is poor but can be greatly improved, at the expense of added ambiguities, by use of frequency multiplication.

621.317.44 **435**

An Electronic Fluxmeter.—R. H. Dicke. (*Rev. sci. Instrum.*, Aug. 1948, Vol. 19, No. 8, pp. 533–534.) Similar in performance to the Grassot meter, but superior to it. Edgar's fluxmeter (3886 of 1937) used the same principles of operation. Operation, circuit and performance details are given.

621.317.44 : 621.314.3† **436**

Applications of the Saturable-Core Magnetometer.—W. E. Tolles. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 504–513.)

621.317.7 **437**

Coaxial Elements and Connectors.—W. R. Thurston. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 97–108.) A general review of the principal u.h.f. methods of measuring impedance, power and voltage, and of matching impedances. A system of coaxial-line units with connectors is described, which may be used to build up apparatus for these measurements. The connectors on all units are identical, and rapid assembly of apparatus is possible.

621.317.725/.726 **438**

Stable Voltmeter Amplifier.—G. R. Woodville. (*Wireless Engr*, Sept. 1948, Vol. 25, No. 300, p. 304.) Comment on 2847 of 1948 (Clare). A better form of the amplifier there described was suggested by Silver (3333 and 3600 of 1945).

621.317.725 : 621.396.611.1 **439**

Electronic Circuit has Logarithmic Response.—A. W. Nolle. (*Electronics*, Sept. 1948, Vol. 21, No. 9, pp. 166..178.) The circuit uses the exponential decay characteristics of a RC circuit. The instrument is designed to measure the time interval required for the voltage under test to decay to a standard value. A specific circuit is described having a 20-db or 30-db scale with accuracy within 0.1 db.

621.317.726 **440**

Peak-to-Peak Voltmeter.—F. H. Shepard, Jr, & E. Osterland. (*Electronics*, Oct. 1948, Vol. 21, No. 10, pp. 101–103.) A discussion of design requirements, with circuit details of a meter for measuring pulses and transients of short duration covering a range of 0.001–1 000 V peak-to-peak or 0.000 35–355 V r.m.s. A near-zero impedance output is achieved by means of pulse-stretching circuits and feedback in the pre-amplifier. Circuit diagrams and voltage/frequency characteristics are given.

621.317.733 : 621.316.86 : 621.317.784 **441**

Self-Balancing Thermistor Bridge.—C. C. Bath & H. Goldberg. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 47–57.) The instrument uses two matched thermistors, one of which is exposed to r.f. power while the other is not. The former is part of a bridge which is in the feedback loop of a 6-kc/s sine-wave oscillator. The latter thermistor, which is exposed to the same ambient temperature, is part of an identical bridge in shunt with the power-measuring bridge. Exposure of the power-measuring thermistor to r.f. power unbalances the second bridge and the unbalance voltage is measured with a valve voltmeter. Temperature compensation is thus automatic. The output is a linear function of the r.f. input power.

621.317.733 : 621.396.677 **442**

Transmission Line Bridge.—A. L. Cullen. (*Wireless Engr*, Sept. 1948, Vol. 25, No. 300, pp. 304–305.) Comment on 2854 of 1948 (Westcott).

621.317.755 **443**

New Cathode-Ray Oscillographs and Applications.—C. Berkley. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, p. 294.) Summary only. Discussion of design features and accessories.

621.317.755 : 531.761 **444**

Short-Time Oscillography.—J. V. Lebacqz. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 68–77.) A mathematical analysis of the deflection of a c.r.o. spot when a transient voltage with linear rise is applied. A method is described for obtaining transient Lissajous figures by the use of a T-junction and phase-delay cables. The patterns obtained can be used to deduce times of rise as small as 10^{-9} sec.

621.317.755 : 535.371.07 **445**

Luminescent Screens for Cathode-Ray Oscillography.—R. Feldt. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, p. 78.) Summary only. Criteria governing the choice of such screens are discussed. The effects of accelerating potential, beam current, spot size, screen efficiency, writing rate, repetition rate, decay time and other factors are evaluated. The requirements for general visual oscillography and for the study of single transient phenomena are compared. A standard method is described for calculating maximum writing rates under given conditions.

621.317.77 **446**

The Phase Meter.—E. O. Vandeven. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 587–592.) A circular trace is produced on a c.r.o. in the usual manner and is modulated in intensity by a pulse derived from the signal whose phase is to be measured. A bright (or dark) spot appears at a particular point on the circle. The phase meter described applies these principles to the case of a 3-phase supply. The relative positions of the three spots on the circle indicate the relative phases directly.

621.317.784 : 621.317.733 **447**

A Balanced Water-Flow Wattmeter for Centimetre Wavelengths.—W. A. Penton & I. R. A. Overton. (*N.Z. J. Sci. Tech.*, Jan. 1948, Vol. 29, No. 4, pp. 215–222.) The r.f. power is balanced against 50-c/s mains power by means of a resistance bridge whose arms are contained in chambers of polystyrene through which a steady stream of water flows.

621.317.79 : 621.396.615 : 621.397.335 **448**

Television Synchronizing Signal Generator.—A. J. Baracket. (*Electronics*, Oct. 1948, Vol. 21, No. 10, pp. 110–115.) Horizontal and vertical driving pulses, the composite blanking signal and the composite synchronizing signal are produced within F.C.C. and R.M.A. specifications.

621.317.79 : 621.396.97 **449**

A Pulse Counter Type F.M. Station Monitor.—N. B. Schrock & D. Packard. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 630–643.) The intermodulation and harmonic-measurement methods for determining a.f. distortion are compared. Curves are given which show the ratio of intermodulation distortion to harmonic distortion as a function of the latter.

621.317.79 : 621.397.7 **450**

Monitor for Television Broadcasting Stations.—M. Silver. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 569–578.) Equipment for monitoring, with the required F.C.C. accuracy, the carrier frequency of the picture transmission and the centre frequency and depth of modulation of the sound transmission.

621.317.794 **451**

Broad Band Bolometer Type U.H.F. Power Meters.—M. J. DiToro. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, p. 119.) Summary only. Broadband performance is achieved by the introduction of complementary reactive elements which annul the inherent inductive component of a resistive bolometer element. Design procedures are discussed for a number of sensitive meters for frequencies from 20 to 10 000 Mc/s and powers from 20 μW to 2 W.

621.396(083.74) **452**

Radio Standards.—L. Hartshorn & L. Essen. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, p. 315. Discussion, pp. 318–324.) Summary of I.E.E. Scientific Radio Convention paper. Discussion of the meaning and terminology of 'standards', of recent improvements in technique, and of the effect of the change from international to absolute units.

621.396.69.001.4 **453**

Tests for the Selection of Components for Broadcast Receivers.—G. D. Reynolds. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 412–413.) Discussion on 2864 of 1948.

621.317.7 + 621-526 + 621.316.72 + 518.5 **454**

Electronic Instruments. [Book Review]—I. A. Greenwood, Jr, J. V. Holdam, Jr, & D. MacRae, Jr (Eds). McGraw-Hill, New York, 1948, 708 pp., $9.00. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, p. 1273.) Vol. 21 of the M.I.T. Radiation Laboratory series. Not only measuring instruments, but also electronic analogue computers, servomechanisms, and voltage and current regulators, are discussed in relation to the war-time work of the Radiation Laboratory.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.746 **455**

The Position " Convectron ", a New Type of Dynamic Vertical Sensitive Element.—M. A. Babb. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 192–196.) The resistance of a very thin straight hot wire in a gas depends on its inclination to the vertical. Two wires inclined to form a 90° *V* are inserted in a bridge whose balance is upset when the *V* is tilted. Tests show that a tilt of 1 minute of arc gives an amplified output of 2 V. The time lag is about 0.1 sec.

535.33 : 538.569.4 **456**

Microwave Spectroscopy.—D. K. Coles. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 180–1 0.) General discussion of apparatus and methods, and of the physical significance of the results obtained.

535.61-15 **457**

German Applications of Infra-Red in World War II.—E. A. Underhill. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 284–293.)

535.61-15 : 534.321.9 **458**

Supersonic Detection of Infra-Red Radiation.—Fry & Fry. (*See* 273.)

535.61-15 : 535.33.072 **459**

High Resolving Power Infra-Red Recording Spectrometer.—R. C. Nelson & W. R. Wilson. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 579–586.) The PbS photoconductive cell developed by Cashman (3330 of 1947) has simplified accurate measurements of radiation of wavelength, up to 3 μ. The design, construction, operation and application of a grating spectrograph for the near infra-red are discussed.

539.16.08 **460**

The Photomultiplier Radiation Detector.—J. W. Coltman & F-H. Marshall. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 377–384.) α, β, γ or X rays, fast ions or neutrons, produce scintillations on a phosphor screen, the light from which is focused on the cathode of a photomultiplier followed by an amplifier. The output pulses may be counted normally or integrated for very high rates. The device has a higher efficiency and counting speed than a G-M counter. Discrimination between wanted and dark-current pulses is discussed.

539.16.08 **461**

Circuit for Testing Efficiency of Geiger Counters.—G. E. Hagen & D. H. Loughridge. (*Rev. sci. Instrum.*, Aug. 1948, Vol. 19, No. 8, pp. 526–528.) The circuit is of the coincidence type, requiring no standardized Geiger tubes or standard sources, and is designed to minimize random errors due to pulse irregularities.

539.16.08 **462**

Some Geiger-Müller and Proportional Counters of Spherical Shape.—G. Salvini. (*Rev. sci. Instrum.*, Aug. 1948, Vol. 19, No. 8, pp. 494–496.) The pulse shape for spherical counters is similar to that for cylindrical counters, but the higher degree of symmetry is an advantage. Slight modifications to avoid spurious discharge are discussed.

621.317.381 : 538.652 **463**

A Magnetostriction Torquemeter.—C. M. Rifenbergh, D. S. Schover & E. H. Schulz. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 493–503.)

621.319.3 : 539 **464**

Precision Studies of Nuclear Physics using the Electrostatic Generator.—W. E. Shoupp. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp, 385–394.) Methods are given for obtaining mass values from threshold determinations of nuclear reactions, the production of variable-energy neutron beams, the determination of the maximum of β-ray spectra, etc.

621.365.5 **465**

High-Frequency Induction Heating. Application to the Theory of [metal-] **Melting Furnaces.**—M. Renouard. (*Rev. gén. Élect.*, Aug. 1948, Vol. 57, No. 8, pp. 322–337.) The theory of the e.m. effects in conductors subjected to h.f. fields is reviewed and applied to a study of the operation of h.f. induction furnaces with no magnetic circuit. Such furnaces have a relatively high efficiency for the melting of metals or alloys of high resistivity, but for low-resistivity materials the efficiency is only moderate. Furnaces operated at a fixed frequency have applications limited to alloys of a particular class, or articles of similar dimensions, if good efficiency is to be maintained.

621.38 **466**

General Trends in Foreign Electronic Developments.—A. H. Sullivan, Jr. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, p. 417.) Summary only. Special reference to war-time German work.

621.38.001.8 **467**

Industrial Applications of Electronic Techniques.—H. A. Thomas. (*J. Instn elect. Engrs*, Part I, Sept. 1948, Vol. 95, No. 93, pp. 381–396.) Discussion on 3992 of 1947.

621.38.001.8 : 531.771 **468**

High-Speed Revolution Counter.—A. B. Kaufman. (*Electronics*, Sept. 1948, Vol. 21, No. 9, pp. 80–82.) The movement of rotating fan, propeller or impeller blades past fixed vanes causes changes in capacitance which are used to vary the oscillation amplitude in a r.f. oscillator. Rectification produces an a.f. output whose frequency is measured on an electronic tachometer. Speeds up to 30 000 r.p.m. can be measured.

621.38.001.8 : 535.241.44 **469**

The Brightness Intensifier.—G. A Morton, J. E. Ruedy & G. L. Krieger. (*RCA Rev.*, Sept. 1948, Vol. 9, No. 3, pp. 419–432.) By certain combinations of optical and electronic apparatus, an image of a scene can be produced with greater brightness than that of the original. The use of such apparatus to improve vision under low light conditions is discussed; the fundamental limit to such improvement is shown to be the statistical fluctuation in the number of photons entering the eye. Applications are discussed.

621.38.001.8 : 786.6 **470**

Design of Electronic Organs: Part 4.—W. Wells. (*Audio Engng, N.Y.*, Sept. 1948, Vol. 32, No. 9, pp. 28–31, 47.) Further details of the Hammond organ, including the construction of the phonic wheels. Part 3: 3203 of 1948.

621.384.6 **471**

A Fifteen-Inch Glass Betatron Toroid.—L. Rushforth, S. J. Morrison & J. G. Brett. (*Electronic Engng*, Aug. 1948, Vol. 20, No. 246, pp. 249–251.) A description of the method of construction from channel rings of low-expansion borosilicate glass, using ovens of special design permitting rotation of the rings for sealing and annealing.

621.384.6 **472**

Electromagnetic Deflector for the Beam of the 184-Inch Cyclotron.—W. M. Powell, L. R. Henrich, Q. A. Kerns, D. C. Sewell & R. L. Thornton. (*Rev. sci. Instrum.*, Aug. 1948, Vol. 19, No. 8, pp. 506–512.) A pulsed electric deflector can impart a radial oscillation to the ions of as much as 7 cm. The ions are forced outward towards a magnetic deflector which is outside the range of the circulating ions.

621.385.38.001.8 : 621.313.36 **473**

Thyratron Control of A.C. Commutator Motors.—W. N. Tuttle. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 514–523.)

621.385.833 : 061.3 **474**

Summarized Proceedings of Conference on Electron Microscopy — London, April 1948.—V. E. Cosslett. (*J. sci. Instrum.*, Sept. 1948, Vol. 25, No. 9, p. 328–331.)

623.746.48 : 621.317.083.7 **475**

Telemetry for Guided Missiles.—Neelands & Hausz. (*See* 425.)

623.746.48 : 621.398 **476**

The Role of Electronics in Guided Missile Research.—W. N. Brown, Jr. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 395–403.)

623.978 + 550.838] : 538.71 **477**

Airborne Magnetometer.—(*Electronics*, Oct. 1948, Vol. 21, No. 10, pp. 124 . . 144.) Brief description of the basic circuit and of the auxiliary circuits necessary for adequate amplification, cancellation of part of the earth's field to avoid saturation, and correct orientation of the sensing element. See also 3336 of 1945 (Vacquier), 220 of 1948 (Felch et al.) and 798 of 1948 (Vacquier, Simons & Hull).

664.8 : 621.319.44 **478**

Heatless Preservation with Penetrating Electrons from the Capacitron.—W. Huber. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 252–271.) For a shorter account see 2325 of 1948.

PROPAGATION OF WAVES

538.566 **479**

Characteristic Values of the First Normal Mode in the Problem of Propagation of Micro-Waves through an Atmosphere with a Linear-Exponential Modified Index of Refraction.—C. L. Pekeris & W. S. Ament. (*Phil. Mag.*, Nov. 1947, Vol. 38, No. 286, pp. 801–824.) Approximate methods used include a variational method, a perturbation method, the method of transitional modes, and the phase integral method. Both surface ducts (superrefraction) and subrefraction are considered: the results are shown graphically. The various methods yield results which agree for most practical applications, especially in the case of superrefraction. The horizontal decrement of the e.m. field beyond the horizon can be deduced in the important case when only the first mode is strongly excited. For subrefraction, two types of solution are found, one associated with the gradient of the refractive index near the surface and the other associated with the upper (standard) portion of the refractive index curve. See also 2892 of 1947 (Booker & Walkinshaw).

538.566 **480**

A Relation between the Sommerfeld Theory of Radio Propagation over a Flat Earth and the Theory of Edge-Diffraction.—H. G. Booker. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 326–327. Discussion, pp. 327–330.) Summary of I.E.E. Scientific Radio Convention paper. For a linear transmitter parallel to the surface of a flat perfectly-conducting earth, the angular spectrum of the reflected waves can be regarded as due to a line source which is the optical image of the transmitter. The correction for imperfect conductivity involves in addition an aperture distribution extending indefinitely downwards from the image line. This aperture distribution is essentially that produced by diffraction of the Zenneck wave under a screen extending from the image line upwards. Ray theory involves calculating the Zenneck-wave diffraction by the edge-wave approximation. When this approximation is unsatisfactory, the full theory of edge diffraction based on the Cornu spiral must be used; this leads to the Sommerfeld theory.

621.396.11 **481**

Transmission Frequencies for Line-of-Sight Systems.—L. S. Schwartz. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 350–370.) Discussion of the factors governing choice of frequency, with particular reference to the case of an interrogator beacon.

621.396.11 : 535.3 **482**

The Intensity-Distance Law in Radiation.—D. A. Bell. (*Wireless Engr*, Oct. 1948, Vol. 25, No. 301, p. 338.) Reply to comment by Lamont & Saxton (3492 of 1948) on Bell's earlier letter (2592 of 1948). Support for Bell's value of critical distance is claimed from a paper by Cutter, King & Kock noted in 1281 of 1948, and from a report on German aerial design practice.

621.396.11 : 551.510.535 **483**

Propagation.—(*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 874–878.) Discussion on 2048 of 1948 (Appleton) and on 2050 of 1948 (Tremellen & Cox).

621.396.11 : 551.510.535 **484**

Propagation of Radio Waves.—W. J. G. Beynon. (*Wireless Engr*, Oct. 1948, Vol. 25, No. 301, pp. 322–330.) A paper originally communicated to the Radio Research Board in 1944. The m.u.f. for the F_2 region was measured by a pulse technique over a transmission path of 715 km. The mean value showed excellent agreement with that calculated from simultaneous normal-incidence equivalent-height measurements made at the terminals of the transmission path. The upper frequency limit of the oblique reflections from the 100-km (abnormal-E) level generally showed no close relationship to the simultaneous normal-incidence observations. For a small number of observations the separation between the oblique penetration frequencies of the two magneto-ionic components was not very different from that measured at normal incidence. The mean seasonal variation of m.u.f. was measured and compared with that calculated from normal-incidence observations.

621.396.11 : 551.510.535 **485**

The Reflection of Radio Waves from the Ionosphere at Oblique Incidence.—W. J. G. Beynon. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, p. 325. Discussion, pp. 327–330.) Summary of I.E.E. Scientific Radio Convention paper. Discussion of: (*a*) the variation of the equivalent path with frequency, and its relation to corresponding measurements at normal incidence, (*b*) calculation of m.u.f. from normal-incidence data, (*c*) ionospheric absorption of radio waves.

621.396.11 : 551.510.535 **486**

The Interaction of Radio Waves.—J. A. Ratcliffe. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, p. 325. Discussion, pp. 327–330.) Summary of I.E.E. Scientific Radio Convention paper. The usefulness of observations of this phenomenon has been extended by observing the phase of the transferred modulation and comparing it with the phase of the modulation received as a ground wave direct from the interacting station. In this way the collision frequency at a known height can be measured. Experiments have given values around 5×10^5/sec for heights around 85 km. The experimental results suggest that the electrons at a distance of 150 km from the Droitwich station (100 kW, 200 kc/s) are maintained at a temperature which is 2% higher than that of the surrounding molecules.

621.396.11 : 551.510.535 **487**

A Frequency Prediction Service for Southern Africa with Special Reference to an Ionosphere Recorder embodying Certain New Techniques.—F. J. Hewitt, J. Hewitt & T. L. Wadley. (*Trans. S. Afr. Inst. elect. Engrs*, April 1948, Vol. 39, Part 4, p. 144.) Authors' reply to discussion on 229 of 1948.

621.396.11.029.4/.52 **488**

The Propagation of Very Long Radio Waves.—R. N. Bracewell. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, p. 326. Discussion, pp. 327–330.) Summary of I.E.E. Scientific Radio Convention paper. Frequencies up to about 50 kc/s are considered. The interference pattern for ranges up to 800 km has been determined using an aeroplane. The height of reflection is about 80 km, with a diurnal variation of 12–18 km. For λ 16 kc/s the reflection coefficient is about 0.5 for angles of incidence near 45° except during the day in summer, when it is about 0.15. Ionospheric disturbances cause a temporary fall of about 3 km in the height of reflection. The effect of reflection on polarization is considered.

621.396.11.029.62 : 551.510.535 : 523.5 **489**

Reflection of Very-High-Frequency Radio Waves from Meteoric Ionization.—E. W. Allen, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, pp. 1255–1257.) Discussion on 2328 of 1948.

621.396.812 : 621.396.9 **490**

Refraction of Radar Beams.—A. E. Carver. (*Weather, Lond.*, Oct. 1948, Vol. 3, No. 10, p. 316.) An example of the superrefraction of radar rays was noted in the ocean weather ship 'Weather Observer' in the North Atlantic on 18th/19th May 1948, when ship echoes were obtained on various bearings at ranges between 70 and 100 miles. Radiosonde measurements of temperature and humidity gradients on these dates indicate that a temperature inversion and a large lapse of humidity favour this phenomenon. See also 492 below (Booker).

621.396.812.029.58 **491**

Simultaneous Observations of Field-Intensity Measurements of WWV at Needham, Massachusetts, and at Intervale, New Hampshire, during the Summer of 1947.—H. T. Stetson & G. W. Pickard. (*Terr. Magn. atmos. Elect.*, March 1948, Vol. 53, No. 1, pp. 67–77.) Continuous field-intensity recording of WWV 5-Mc/s and 10-Mc/s signals at a distance of 373 miles show that the diurnal variation undergoes progressive seasonal and sunspot-cycle changes. Simultaneous measurements made at a distance of 463 miles in the same direction show the same general form of diurnal variation, and coincidence of sudden ionospheric disturbances. Similar results were also obtained at a distance of 270 miles in the same direction from the transmitter, so that the observations may be expected to apply over a region approximately 200 miles across.

621.396.812.029.64 **492**

Radio Refraction in the Atmosphere.—H. G. Booker. (*Weather, Lond.*, Feb. 1948, Vol. 3, No. 2, pp. 42–50.) Examples of extraordinary radar ranges observed in various parts of the world are described and discussed. For a more detailed account see 515 of 1947.

621.396.812.029.64 **493**

Comparison of Calculated and Measured Phase Difference at 3.2 Centimeters Wavelength.—E. W. Hamlin & W. E. Gordon. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, pp. 1218–1223.) The variation, with height, of the magnitude and phase of the field for a 27-mile near-optical desert path could be calculated from the direct wave and one reflected from a surface tangential to the earth's profile at the point of reflection, provided that the variation of atmospheric refractive index with height was linear. Apparent reflection coefficients between 0.3 and 0.8 were found.

RECEPTION

621.396.621 + 621.396.619.13 + 621.396.97 **494**

F.M. Profits.—M. B. Sleeper. (*FM & Televis.*, Sept. 1948, Vol. 8, No. 9, pp. 27, 50.) The organizers of Rural Radio Network find that a receiver operational threshold of 20 μV/m is necessary for good f.m. reception at all points within the 50-μV/m contours of their proposed stations. Most f.m./a.m. receivers tested had threshold values between 250 and 500 μV/m. Specifications for suitable f.m. receivers and aerials have now been determined; units meeting these requirements should bear a recognized mark. For further details of the Network see 495, 523, 551, 594, 595 and 596 below.

621.396.621 + 621.396.67 **495**

Pattern for F.M. Profits: Part 5 — Receiver and Antenna.—W. C. Black. (*FM & Televis.*, Sept. 1948, Vol. 8, No. 9, pp. 36–39, 43.) Mobile reception tests with field-strength measuring equipment enabled a f.m. receiver specification to be drawn up. The G.L.F. Model F-770 receiver was designed to meet this specification. For non-directional reception of horizontally polarized radiation a single turnstile aerial, composed of two folded dipoles, was adopted. A second turnstile, in a stacked array, can be added to increase the gain. See also 494 above.

621.396.621 : 621.396.611.1 **496**

Formulas for Image Rejection Calculations.—Vladimir. (*See* 332.)

621.396.621.54 : 621.396.611.21 **497**

A Review of Crystal Saver Circuits for V.H.F. Receivers.—W. R. Hedeman, Jr. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 449–456.) Circuits for obtaining as many as 280 crystal-controlled channels with few crystals. See also 2342 of 1948.

621.396.622 **498**

Superregenerative Detection Theory.—W. E. Bradley. (*Electronics*, Sept. 1948, Vol. 21, No. 9, pp. 96–98.) The operation of the superregenerative circuit is explained in terms of a time aperture function, depending on the quenching waveform. A theory is developed to identify the factors controlling selectivity, optimum quenching, and signal/noise ratio, and to account for the difficulty of reproducing a given response in different types of detector. See also 499 below.

621.396.622 **499**

Superregenerator Design.—A. Hazeltine, D. Richman & B. D. Loughlin. (*Electronics*, Sept. 1948, Vol. 21, No. 9, pp. 99–102.) Theoretical values for the gain in either the logarithmic or linear mode of superregenerative receivers are obtained by considering the build-up of oscillations in the transient condition resulting from the application of a short r.f. pulse. Sensitivity limitations are discussed and expressions derived for the selectivity with various specific quenching waveforms. See also 3501 of 1948 (Macfarlane & Whitehead) and 498 above.

621.396.622 **500**

An Analysis of the Behavior of a Limiter-Discriminator F.M. Detector in the Presence of Impulse Noise.—J. C. Tellier. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 680–696.) Experimental results indicate how the limiter-discriminator differs from an ideal f.m. detector. The response of the discriminator to noise is discussed.

621.396.8 : 621.396.619.11 **501**

Basic Considerations on the S/N Ratio in Amplitude Modulated Receivers.—E. C. Fubini & D. C. Johnson. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, p. 39.) Summary only. The signal/noise ratio S at the audio or video output of an a.m. receiver is the same as S_2, the signal/noise ratio at the input of the second detector, in receivers for broadcasting and similar applications. But S and S_2 are unequal when the i.f. bandwidth is much greater than the video or audio bandwidth, as may be the case in v.h.f. or u.h.f. systems. Experimental data on the relations between these quantities and the input signal are included.

621.396.81 : 621.396.619 **502**

Signal-to-Noise Ratios in Pulse Modulation Systems.—B. Håård. (*Ericsson Technics*, 1948, No. 47, 31 pp. In English.) Signal/noise ratios are calculated for amplitude, frequency, phase, pulse-amplitude, pulse-width and pulse-time modulation systems. Comparisons are based on the ratio for a.m. systems. In a conventional a.m. system the ratio of signal power to noise power per unit bandwidth is constant through the receiver. The same result is obtained by the use of bottom limiting with pulse-amplitude modulation, but, for the same mean r.f. signal power, with pulse-width modulation there is a gain proportional to the duty cycle and to the pulse spectrum bandwidth, while with pulse-time modulation there is a gain inversely proportional to the duty cycle and directly proportional to the pulse spectrum bandwidth.

621.396.82 **503**

Impulsive Interference in Amplitude-Modulation Receivers.—D. Weighton. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, p. 370.) Discussion on 2901 of 1948.

621.396.82 : 621.396.932 **504**

External Cross-Modulation in the 100-Mc/s Band.—K. W. Blake. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 13, pp. 659–662 : summary, *ibid.*, Part IIIA, 1947, Vol. 94, No. 11, p. 114.) Interference often occurs in naval h.f. communication when the separation between two transmitted frequencies is the same as that between one of these frequencies and the receiving frequency. This effect was found to be due to parts of the ship's structure, particularly corroded joints, which acted as nonlinear conductors. Equipment for locating such sources of interference is described and its performance discussed.

621.396.822 **505**

Some Notes on Noise Figures.—H. Goldberg. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, pp. 1205–1214.) A clarification of the basic ideas and definitions for thermal noise and noise factors proposed by H. T. Friis (3457 of 1944). Noise factors are determined for grounded-cathode, grounded-grid and grounded-anode amplifiers and for the Wallman low-noise circuit (grounded-cathode stage followed by grounded-grid stage). Transit-time effects and the use of noise diodes are discussed.

621.396.822 **506**

A Survey of Recent Progress in the Study of Fluctuation Noise.—D. K. C. MacDonald. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 330–331. Discussion, pp. 334–340.) Summary of I.E.E. Scientific Radio Convention paper. Discussion of recent work on such noise arising within the receiver unit itself. See also 534 of 1948 (Thomas & Burgess).

621.396.822 : 551.594.6 **507**

The World Distribution of Radio Noise.—Thomas. (*See* 396.)

621.396.823 **508**

An Experimental Investigation of Motor-Vehicle Ignition Interference.—H. Page & G. G. Gouriet. (*B.B.C. Quart.*, Oct. 1948, Vol. 3, No. 3, pp. 182–192.) Results of tests to determine the effects of such interference on wide-band f.m. broadcasting at 45 Mc/s and at 90 Mc/s are discussed. The interference was found to be 6–10 db less with horizontal than with vertical polarization. For a given field strength, interference was less for 90-Mc/s than for 45-Mc/s radiation.

621.396.828 **509**

Some Fundamental Considerations concerning Noise Reduction and Range in Radar and Communication.—S. Goldman. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, p. 191.) Summary only. Analysis of noise reduction in f.m., pulse-width-modulation, multi-channel signalling and radar serves as a background to the general theory. The distinction between signals and random noise, and the significance of selectivity and coherence, are discussed. A probability measure of noise level is introduced and theory is developed which deals adequately with radar range problems. Maximum range in communication is shown to be independent of the type of modulation, for a given total energy.

621.397.62 **510**

R.F. Input Circuits for TV Receivers.—F. R. Norton. (*Tele-Tech*, Oct. 1948, Vol. 7, No. 10, pp. 28–31, 57.) Idealized performance characteristics are shown graphically and discussed. Detailed diagrams of various experimental and commercial circuits are given.

621.396/.397].62.001.4 **511**

Television and F.M. Receiver Servicing. [Book Review]—M. S. Kiver. D. Van Nostrand, New York, 1948, 203 pp., $2.95. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, p. 1273.) A practical treatment.

STATIONS AND COMMUNICATION SYSTEMS

621.391.64 : 621.327.44 **512**

Dynamic Properties of the Infra-Red Cesium Arc.—J. M. Frank & W. S. Huxford. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 525–536.) The dynamic electrical properties of the Type CL-2 lamp have been determined for frequencies from 50 c/s to 1 Mc/s. See also 2353 of 1948 (Frank, Huxford & Wilson).

621.395.47 **513**

Analysis-Synthesis Telephony, with special reference to the Vocoder.—R. J. Halsey & J. Swaffield. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 391–406. Discussion, pp. 406–411.) Full paper: summary noted in 2910 of 1948.

621.396.4 : 621.396.97 **514**

Program Transmission over Broadband Carrier Systems.—R. W. Chesnut. (*Bell Lab. Rec.*, Sept. 1948, Vol. 26, No. 9, pp. 377–382.) A new system is described for high-grade programme transmission, with a pass band of 40–8 000 c/s. Block diagrams of the equipment are given.

621.396.41 **515**

Theoretical Analysis of Various Systems of Multiplex Transmission.—V. D. Landon. (*RCA Rev.*, Sept. 1948, Vol. 9, No. 3, pp. 433–482.) Continuation of 3246 of 1948. The power requirements for a 10-Mc/s maximum bandwidth and the actual bandwidth requirements of eighteen different systems are calculated and tabulated. The susceptibility of the different systems to impulse noise, cross modulation, interference and selective fading is analysed and theoretical and practical results for several systems are compared.

621.396.41 : 621.396.619.16 **516**

A 96-Channel Pulse Code Modulation System.—C. B. Feldman. (*Bell Lab. Rec.*, Sept. 1948, Vol. 26, No. 9, pp. 364–370.) Discussion of the relative merits of pulse-code modulation and other systems, and brief description of an experimental system and its mode of operation. See also 2366 of 1948 (Meacham & Peterson).

621.396.61/.62].029.63 : 621.396.931 **517**

The Citizens Radio Service.—R. E. Samuelson. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 272–283.) The present F.C.C. regulations are outlined, the advantages and limitations of low-power u.h.f. systems and the propagation characteristics for 465-Mc/s waves are discussed and suitable equipment is described. See also 3511 of 1948 (Lurie) and back references.

621.396.619.13 : 621.396.3/.5 **518**

The Possibility of Transatlantic Communication by means of Frequency Modulation.—L. B. Arguimbau & J. Granlund. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 644–653.)

621.396.619.16 **519**

General Considerations in Pulse-Count Modulation.—S. Metzger & D. D. Grieg. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 457–467.) Discussion of fundamental properties and operating principles of this system, and of the relation between distortion and the number of quantization levels.

621.396.619.16 : 621.385.832 : 621.396.41 **520**

Beam Deflection Tube for Coding in P.C.M.—Sears. (*See* 576.)

621.396.65 **521**

Communication by Means of Reflected Power.—H. Stockman. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, pp. 1196–1204.) A short-distance communication system is discussed in which the carrier power is generated at the receiving end and the transmitter replaced by a mechanically-modulated reflector. A very-high-gain transmitting aerial producing a practically parallel beam incident upon a mirror large compared to λ is desirable. Some experimental results and methods of modulating the reflector are given. The system is not considered practicable at present.

621.396.7 + 621.397.2 **522**

Engineering Arrangements for Broadcasting the Olympic Games.—L. Hotine. (*B.B.C. Quart.*, Oct. 1948, Vol. 3, No. 3, pp. 174–181.) A plan of the broadcasting centre and a schematic diagram showing the technical arrangements are given. The centre incorporated 8 studios, 20 recording rooms, 8 disk-reproducing cubicles, 11 disk-editing rooms, the control room and the television control and production rooms. Provision was made for 36 simultaneous broadcasts. 52 commentators' positions were installed, each of which had the following services available through headphones: (*a*) B.B.C. (Home), (*b*) B.B.C. (Light), (*c*) public address system, (*d*) local effects, (*e*) output from control position to which commentator was connected, (*f*) control operator's telephone, (*g*) TIM speaking clock.

621.396.712 **523**

Pattern for F.M. Profits: Part 2 — Organization.—R. B. Gervan. (*FM & Televis.*, Sept. 1948, Vol. 8, No. 9, pp. 29–30..65.) The Rural Radio network maintains 6 f.m. stations in New York State. Each transmitter is at least 2 000 ft above sea level, and coverage is complete over a wide area. See also 494 above.

621.396.931 **524**

Bridged Circuits Facilitate Police Radio.—(*Tele-Tech*, July 1948, Vol. 7, No. 7, pp. 28–29, 94.) A f.m. R/T system used by New York State police. It consists of radio and telephonic links between troopers, substations and headquarters. 41 fixed transmitting and receiving stations, 363 mobile transmitting-receiving sets and 42 walkie-talkies are linked by switching and bridge circuits without mutual interference. Each bridge includes a reversible amplifier, operating in either direction and controlled by a switch on a hand telephone.

621.396.931 : 621.396.619.23 **525**

The Miller F.M. Circuit and its Use in Railroad Radios.—Bargellini. (*See* 343.)

621.396.97 **526**

War-Time Broadcasting.—(*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 16, pp. 871–874.) Discussion on 2086 of 1948 (Bishop).

621.396.97 : 621.316.729 **527**

The Problem of Synchronization in Broadcasting on Medium or Long Waves.—S. Lacharnay. (*Onde élect.*, Aug./Sept. 1948, Vol. 28, No. 257, pp. 308–321.) The general conditions are considered under which a field due to three waves, a carrier and its two sidebands, can be detected by classical methods without undergoing distortion. Three practical conditions are found: (*a*) of amplitude, (*b*) of phase and (*c*) of supermodulation. The interference of the fields of two synchronized transmitters is studied. Consideration of the distortion shows that satisfactory reception is only possible in the immediate neighbourhood of the two transmitters. A case of particular interest is that of two low-power transmitters covering a small district of about 100 km^2.

With suitable l.f. phase control, reception is possible throughout the district. A frequency stability within 1 part in 10^7 is adequate; greater stability than this gives no improvement in reception. The case of more than two powerful transmitters remains to be considered, and also the question of a network of synchronized transmitters serving a wide district, taking account of the possibility of using directive aerials.

621.396.97 : 621.396.81 **528**

Circular Polarization in F.M. Broadcasting.—C. E. Smith & R. A. Fouty. (*Electronics*, Sept. 1948, Vol. 21, No. 9, pp. 103–107.) Experimental field-strength measurements in 36 typical homes confirm the theoretical advantages of circular polarization over horizontal polarization. Aerial development is discussed.

621.396.619.13 **529**

Frequency Modulation: Vol. 1. [Book Review]—A. N. Goldsmith, A. F. Van Dyck, R. S. Burnap, E. T. Dickey & G. M. K. Baker (Eds). RCA Review, Princeton, N.J., 1948, 515 pp., $2.50. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, p. 1273.) Vol. 7 of the R.C.A. Technical Book series, containing papers published by R.C.A. authors between 1936 and 1947.

SUBSIDIARY APPARATUS

621-526 **530**

A High-Capacity Servo-System for the Control of a Testing Machine.—H. W. Katz & H. C. Roberts. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 295–308.)

621.314.67 : 621.385.2.032.216 **531**

Power Diodes.—E. G. Rowe, R. E. B. Wyke & W. MacRae. (*Electronic Engng*, July–Sept. 1948, Vol. 20, Nos. 245–247, pp. 214–218, 254–259 & 285..291.) Detailed discussion of the various factors involved in the design of high-vacuum rectifiers with oxide-coated cathodes, with an account of production and routine test methods. A system of rating for such rectifiers is presented which enables the constants of the associated circuits to be found directly from tables and curves.

621.352.7 **532**

Magnesium Batteries.—(*Metal Ind., Lond.*, 8th Oct. 1948, Vol. 73, No. 15, p. 286.) The electrochemical principles that suggest the advantages of using Mg instead of Zn in primary cells, are described by R. Fichter (533 below). With Mg in the MnO_2/C type of cell, the terminal voltage is 2.2 V and the theoretical capacity is 4.8 Wh/gm, which is 4 times that of the cell with Zn as the negative electrode. Developments in America include the Mg/AgCl/Ag batteries made by the Burgess Battery Co. (see 3295 of 1947). A Mg/C cell with chromic acid as the electrolyte has been patented by the Dow Chemical Co. A cell capable of regeneration, with Mg and Pb sulphate or halide and a neutral salt electrolyte, is described in a patent by the Compagnie Générale d'Électricité. Experiments by the Aluminium Industrie A.G. (Chippis) show that surface treatment of the Mg containers in a dichromate-nitric acid bath not only increases the corrosion resistance but also raises the cell voltage to 2.6–2.7 V. As regards output, two such cells are equivalent to three cells of the Zn type. The electrolyte used in these cells contains 20% $Na_2S_2O_8$, 6% Na_2SO_4, 0.2% NaHO and 0.5% $K_2Cr_2O_7$. The containers are made from a Mg/Al alloy, containing 6% Al, which can be extruded by impact without preheating.

621.352.7 **533**

Galvanic Elements using Magnesium.—R. Fichter. (*Chimia, Zürich*, 15th July 1947, Vol. 1, No. 7, pp. 141–146.) The full paper referred to in 532 above.

621.396.68 : 621.314.653 **534**

Sealed Ignitrons for Radio-Transmitter Power Supplies.—Zuvers. (*See* 556.)

621.317.7 + 621-526 + 621.316.72 + 518.5 **535**

Electronic Instruments. [Book Review]—Greenwood, Holdam & MacRae. (*See* 454.)

TELEVISION AND PHOTOTELEGRAPHY

621.397 **536**

The Chemistry of High-Speed Electrolytic Facsimile Recording.—H. G. Greig. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, pp. 1224–1235.) A brief survey of various processes.

621.397.331.2 **537**

The Eriscope Camera Tube.—B. France. (*Electronics*, Oct. 1948, Vol. 21, No. 10, p. 130.) A description of the functioning of a television camera tube in which the formation of the electrical image and scanning are separate operations, as with the image orthicon, and therefore can be designed independently for maximum efficiency. Tests indicate that the ériscope has a greater resolution than the image orthicon, with a definition of 800–1 000 lines, but is less sensitive, particularly with artificial light. See also 1776 of 1948.

621.397.331.2 : 535.65 **538**

Color Measurement and Specification in Television Picture Tubes.—E. B. Fehr. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 558–567.) The quantitative results obtainable by spectrophotometry or by relative transmission through filters are preferred to those given by the Munsell matching system.

621.397.331.2 : 621.385.832 **539**

The Chromoscope—A New Color Television Viewing Tube.—A. Bronwell. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 549–557.) For another account see 2937 of 1948.

621.397.331.2 : 621.397.5 **540**

Electro-Optical Characteristics of Television Systems: Part 3 — Electro-Optical Characteristics of Camera Systems.—O. H. Schade. (*RCA Rev.*, Sept. 1948, Vol. 9, No. 3, pp. 490–530.) Part 1, 2940 of 1948; part 2, 3261 of 1948.

621.397.335 : 621.317.79 : 621.396.615 **541**

Television Synchronizing Signal Generator.—Baracket. (*See* 448.)

621.397.5 **542**

Television Definition and Bandwidth.—H. L. Kirke. (*B.B.C. Quart.*, Oct. 1948, Vol. 3, No. 3, pp. 171–173.) The definition of a television system is improved by increasing the number of lines only when this is accompanied by a corresponding increase in the bandwidth. Tables show the relationship between bandwidth, number of lines, and horizontal and vertical definition.

621.397.6 : 621.395.625.6 **543**

Television Transcriptions.—T. T. Goldsmith, Jr, & H. Milholland. (*Electronics*, Oct. 1948, Vol. 21, No. 10, pp. 68–71.) Discussion of the recording of television images on film direct from a c.r. monitor.

621.397.62 **544**

Television Front Ends.—A. D. Sobel. (*Electronics*, Sept. 1948, Vol. 21, No. 9, pp. 76–79.) Discussion of the r.f. stage and of oscillator and mixer problems; current design trends are noted. Methods of measuring performance and of tuning are also considered.

621.397.62 **545**

R.F. Input Circuits for TV Receivers.—Norton. (*See* 510.)

621.397.62 : 621.396.665 **546**

Automatic Gain Controls for Television Receivers : Parts 1 & 2.—Wendt & Schroeder : Wendt. (*See* 351 and 352.)

621.397.8 **547**

London Television Transmissions Received Perfectly in France.—G. Giniaux. (*T.S.F. pour Tous*, Sept. 1948, Vol. 24, No. 239, p. 237.) Television pictures from London are regularly received in Calais, 153 km from London, with a stability which is not reached with some receivers no more than 4 km from the Eiffel tower. Synchronization is definitely better than for the Paris transmissions, as is to be expected, since the distance from Calais to Paris is 230 km. The aerial is about 25 m above ground level and consists of a vertical doublet provided with a reflector and also a horizontal counterpoise. No preamplifier is found necessary.

621.396/.397].62.001.4 **548**

Television and F.M. Receiver Servicing. [Book Review]—Kiver. (*See* 511.)

TRANSMISSION

621.396.61 **549**

A New 50-kW F.M. Transmitter.—C. J. Starner. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 615–629.) Description of the R.C.A. Type BTF-50A, a transmitter for the frequency range 88–108 Mc/s. The output stages are self-contained coaxial-type units using air-cooled grounded-grid triodes.

621.396.61 **550**

The Pack Transmitter.—J. L. Hathaway & W. Hotine. (*RCA Rev.*, Sept. 1948, Vol. 9, No. 3, pp. 483–489.) Description and circuit diagram of a portable, low-power, crystal-controlled transmitter for frequencies of 25–32 Mc/s and with a range of 1–20 miles.

621.396.61 **551**

Pattern for F.M. Profits: Part 6 — Transmitters.—D. K. De Neuf. (*FM & Televis.*, Sept. 1948, Vol. 8, No. 9, pp. 40–43.) Description of the 6 Rural Radio Network 250-W transmitters operating on frequencies around 100 Mc/s. The stations are linked by radio and no land lines are used. The distance between adjacent transmitting stations is 46–75 miles. A 50-W mobile transmitter with a range of 50 miles enables any broadcast to reach all parts of the network. A studio/transmitter link included in the system was described in 3516 of 1948 (Nigg). See also 494 above.

621.396.61 **552**

300 Watt Type SK23A Short-Wave Transmitter.—K. Lutz. (*Brown Boveri Rev.*, March/April 1948, Vol. 35, Nos. 3/4, pp. 91–94.) A low-power, general-purpose transmitter for either stationary or mobile operation. The basic unit consists of a crystal oscillator, an output stage and power supplies. Additional units such as a modulator, a variable-frequency oscillator, and remote control equipment can be added to meet all operating requirements.

621.396.61 **553**

The TGS571 Transmitter.—C. P. Cooper. (*Marconi Rev.*, July/Sept. 1948, Vol. 11, No. 90, pp. 78–86.) The basic design requirements for a general-purpose remotely-controlled transmitter are discussed and their application to the case of a 500-W transmitter with a continuous frequency coverage from 2.5–20 Mc/s is considered.

621.396.61 : 621.396.712(494) **554**

The New 200 kW Medium-Wave Transmitter for the Swiss National Broadcasting Station at Beromünster.—K. Seiler. (*Brown Boveri Rev.*, March/April 1948, Vol. 35, Nos. 3/4, pp. 77–81.) Anode modulation of the class-C output stage is achieved by a specially developed modulation transformer enabling greater efficiency to be obtained than that possible with class-B operation of the former 100-kW transmitter. The valves are heated by a.c., so that rotary converter equipment is unnecessary. A detailed account will be published when the installation is completed.

621.396.61.029.56/.58 **555**

807s in Push-Pull.—D. H. Mix. (*QST*, Aug. 1948, Vol. 32, No. 8, pp. 11–15, 108.) Circuit and construction details of a shielded stabilized transmitter for the amateur bands. 3.5-Mc/s and 7-Mc/s crystals are used, followed by a buffer stage to prevent overloading of the crystal. Plug-in coil changing is facilitated by the hinged lid enclosing the whole of the upper part of the oscillator. Harmonic filters are included to prevent interference with television reception.

VALVES AND THERMIONICS

621.314.653 : 621.396.68 **556**

Sealed Ignitrons for Radio-Transmitter Power Supplies.—H. E. Zuvers. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 309–321.) The use of ignitrons as very fast circuit breakers to protect power supplies becomes economical above about 100 kW. The new tetrode ignitron GL-5630 is rated at 20 kV and 50 A ; six of these in a bridge circuit would supply 3 000 kW d.c. Output voltage control is achieved by varying the angle of firing.

621.385 **557**

Foreign Vacuum Tubes and High Frequency Techniques.—B. L. Griffing. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, pp. 418–428.) General discussion of German developments, including metal/ceramic valves, Heil's focusing cathode, image storage tubes, and valves for λ 10 cm to λ 3 mm.

621.385 : 537.533.8 **558**

Secondary Electron Suppression.—J. H. Owen Harries. (*Wireless Engr*, Sept. 1948, Vol. 25, No. 300, pp. 275–280.) Theoretical analysis of secondary-electron radiation in microwave cavity valves requires drastic simplifying assumptions ; the undesirable results of secondary-electron emission appear to be reduced over a considerable range of transit angles around $\pi/2$. Measurements of the transfer of power from a modulated electron beam to an electric field in a gap in the presence of secondary electrons at transit angles from zero to π are discussed and compared with the theory. With a recessed target the transfer efficiency is considerably higher than with a plane target and has a maximum value of about 46% at an optimum transit angle of about 0.3π.

621.385 : 621.315.2 **559**

An Ionic Valve for Clearance of Faults in Cables.—R. Schmidt. (*Bull. Soc. franç. Élect.*, Aug./Sept. 1948, Vol. 8, No. 84, pp. 430–432.) One type of valve has a tubular glass envelope 20–70 cm long and 3 cm in diameter; the filling is Hg vapour. An oxide cathode is fitted at one end and a cylindrical cup as anode at the other end. Between anode and cathode there is a set of auxiliary electrodes which serve as a voltage divider; their action is assisted by series capacitors connected between anode and cathode, a spark gap being introduced between the two capacitors nearest the cathode. Only about 19 V are required to maintain an arc in the Hg vapour in one direction, but no arc can be started in the opposite direction. A valve of length 63 cm and with 9 stages will support a reverse voltage of 200 kV. The operating temperature should be in the range 18°–40°C. Various applications are mentioned.

621.385 : 621.316.722.1 **560**

Voltage Reference Tube.—(*Elect. Rev., Lond.*, 26th Nov. 1948, Vol. 143, No. 3705, p. 817.) The Mullard 85A1 tube, in a self-regulated constant-current circuit, gives a stable voltage that can be used in many cases as a reference. The ignition voltage is 125 V and the normal operating voltage 85 V. Stability is within 0.1% up to 100 hours and within 0.2% up to 1 000 hours. Its low temperature coefficient (-3.5 mV/°C) makes temperature control unimportant.

621.385.029.63/.64 **561**

The Experimental Development of [3-cm] **Traveling-Wave Tubes.**—J. S. A. Tomner. (*Chalmers tekn. Högsk. Handl.*, 1948, No. 67, 22 pp. In English.) Output curves show the beam voltage as a function of the focusing magnetic field. The observed and theoretical gains are compared. The effect of the potential of the focusing electrode on the output is also shown. See also 2962 of 1948 (Rydbeck).

621.385.032.216 **562**

The Relationship between the Emission Constant and the Apparent Work Function for Various Oxide-Coated Cathodes.—H. Jacobs, G. Hees & W. P. Crossley. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1948, Vol. 36, No. 9, pp. 1109–1114.) The emission of oxide cathodes on 6 chemically different metal wires was measured over a period of 500 hours. An empirical emission equation was found to be as accurate as, and easier to use than, the conventional Dushman equation ; the logarithm of the emission constant was found to be the sum of a constant and a term proportional to the apparent work function.

621.385.032.216 : 537.533 **563**

The Emission of Negative Ions from Oxide Coated Cathodes.—R. H. Sloane & C. S. Watt. (*Proc. phys. Soc.*, 1st Sept. 1948, Vol. 61, No. 345, pp. 217–234.) Mass/charge ratios were determined for a large number of negative ions from the different cathodes used. Energy distribution curves are plotted for the more intense ion beams ; these permit discrimination between negative ions produced thermionically and those produced by bombardment. Results are also given showing the dependence of the thermionic emission on the cathode temperature, and the variation of this emission with time after changes in cathode temperature, accelerating field, and cathode surface conditions. The results are discussed and compared with those of other workers.

621.385.032.44 **564**

Series Capacitor Heater Circuits.—A. W. Stanley. (*Wireless World*, Sept. 1948, Vol. 54, No. 9, pp. 332–334.) The advantages of such circuits over series resistor circuits are discussed. There is negligible power loss and better regulation. Graphical methods of determining circuit parameters in particular cases are explained.

621.385.1 **565**

New Miniature 'Rimlock' Valves for A.C. Receivers.—J. Rousseau. (*T.S.F. pour Tous*, Sept. 1948, Vol. 24, No. 239, pp. 226–233.) Characteristics and complete data for the ECH41 triode-hexode, EAF41 diode-pentode, EF41 variable-μ h.f. pentode, EL41 output pentode and AZ41 rectifier, with circuits suitable for their use. See also 3552 of 1948 (Giniaux).

621.385.2 **566**

Effects of Hydrostatic Pressure on Electron Flow in Diodes.—W. C. Hahn. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1948, Vol. 36, No. 9, pp. 1115–1121.) A single equation holds from the cathode surface through the potential minimum to the anode if the hydrostatic pressure term, with constant temperature, is included in the electron force equation. From this equation the usual temperature-limited emission formula for maximum current, the space-charge-limited characteristic and the transition region from one to the other may all be deduced. This result is discussed in relation to transport theory.

621.385.2 : 621.396.822 **567**

The Behaviour of a Diode Noise Generator at Ultra High Frequencies.—A. W. Love. (*J. Instn Engrs Aust.*, April/May 1948, Vol. 20, Nos. 4/5, pp. 33–42.) Discussion of the effects of internal diode impedance and transit time on the absolute accuracy as a voltage source at u.h.f. The magnitudes of the effects are determined experimentally at 200 Mc/s for a Type X-6030 noise diode by comparison with a thermal generator. Noise output is shown to depend on anode voltage, unless this is high enough to ensure complete temperature-limited operation. It is concluded that the X-6030 diode can be used up to about 500 Mc/s with an error < 1 db in noise power output, provided certain precautions are taken. Analysis shows that a diode built as a concentric transmission line and terminated at one end in its characteristic impedance could be used at still higher frequencies.

621.385.2.032.216 : 621.314.67 **568**

Power Diodes.—Rowe, Wyke & MacRae. (*See* 531.)

621.385.3 **569**

A New 100-Watt Triode for 1 000 Mc/s.—W. P. Bennett, E. A. Eshbach, C. E. Haller & W. R. Keye. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, pp. 1296–1302.) The mechanical construction and mass-production methods are described for the grounded-grid triode Type 5588, which has coaxial heater leads and cathode and uses forced-air cooling. Axial length of the electrode structure is about $\frac{1}{2}$ inch. The use of the valve as power oscillator and amplifier is discussed, with circuit details.

621.385.3 : 621.396.615.14 **570**

Triodes for Very Short Waves — Oscillators.—Bell, Gavin, James & Warren. (*See* 338.)

621.385.3.032.24 : 621.396.822 **571**

Negative-Grid Partition Noise.—R. L. Bell. (*Wireless Engr*, Sept. 1948, Vol. 25, No. 300, pp. 294–297.) In the conventional negative-grid triode the e.s. field about the grid is not uniform because of the discrete nature of the grid wires. The effect of this on the fluctuations induced at the grid is analysed. Variations in pulse shape are shown to cause some u.h.f. noise when the ratio of the grid-winding pitch to the grid/cathode spacing is large.

621.385.38 **572**

A New Line of Thyratrons.—A. W. Coolidge, Jr. (*Proc. nat. Electronics Conference, Chicago*, 1947, Vol. 3, p. 197.) Summary only. A new method of construction is claimed to meet various requirements of quick heating, high peak-to-average current ratio, wide ambient temperature range, high surge-current rating, dual grid control, compactness, ruggedness, reliability, and low cost. Performance data are included.

621.385.4 : 537.58 **573**

Space-Charge Effects in Beam Tetrodes and Other Valves.—C. S. Bull. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, p. 362.) Discussion on 2668 of 1948.

621.385.831 : 621.396.822 **574**

Low-Frequency Noise from Thermionic Valves Working under Amplifying Conditions.—E. J. Harris & P. O. Bishop. (*Nature, Lond.*, 19th June 1948, Vol. 161, No. 4103, p. 971.) The intensity of this noise varies approximately inversely as the frequency in the range 10–1 000 c/s. At 1 000 c/s it was not observable above the shot noise. It was remarkably constant for different valves.

621.385.832 **575**

Metal Picture Tube.—(*Electronics*, Oct. 1948, Vol. 21, No. 10, pp. 152, 156.) A 16-inch c.r. tube with a metal shell, for television receivers. A glass neck houses the electron-gun assembly.

621.385.832 : 621.396.41 : 621.396.619.16 **576**

Beam Deflection Tube for Coding in P.C.M.—R. W. Sears. (*Bell Lab. Rec.*, Oct. 1948, Vol. 26, No. 10, pp. 411–415.) For the system noted in 516 above. See also 2411 of 1948.

621.385.832 : 621.396.9 **577**

Three-Dimensional Cathode-Ray Tube Displays.—E. Parker & P. R. Wallis. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 371–387. Discussion, pp. 387–390.) The display of three-dimensional information is considered with particular reference to a radar system in which a narrow pulsed beam of r.f. energy is used to explore automatically a volume of space. Truly 3-dimensional displays use a mechanical motion to add a third dimension to the c.r.t. screen. Perspective displays simulate the same picture without any moving mechanisms or stereoscopy. Oblique displays obtain the required three coordinates by combination of two or more 2-coordinate displays on the same c.r. tube. Polychromatic displays use colour to represent a spatial coordinate. Human operator problems, display sensitivity and applications are also discussed.

621.396.615.141.2 : 513.761.5 **578**

Certain Matters concerning Scaling in the Magnetron with Special Reference to the Relative Efficiency of Magnetrons of Different Sizes.—W. F. G. Swann. (*J. Franklin Inst.*, Aug. 1948, Vol. 246, No. 2, pp. 149–157.)

621.396.615.141.2 : 621.396.615.17 **579**

Pulser and Water Load for High Power Magnetrons.—S. I. Svensson. (*Chalmers tekn. Högsk. Handl.*, 1948, No. 68, 27 pp. In English.) The principles of the line-modulator type of pulser using diode charging are discussed and a practical circuit is described. Oscillograph records show the voltage at points in the circuit and the final pulse shape. The water load consists of a concentric line, the inner conductor being tapered for 2 wavelengths and surrounded by water contained in a glass tube. The temperature rise caused by the absorption of r.f. energy in the water enables peak powers up to 700 kW to be measured.

621.396.615.142.2 **580**

The Manufacture of a Reflex Klystron.—D. L. Hollway. (*J. Brit. Instn Radio Engrs*, May/June 1948, Vol. 8, No. 3, pp. 97–109.) See 1519 of 1948.

621.396.645 : 537.311.33 : 621.315.59 **581**

Design of Amplifying Crystal Units.—S. Y. White. (*Audio Engng, N.Y.*, Sept. 1948, Vol. 32, No. 9, pp. 26–27..45.) To obtain the maximum power output from an amplifying crystal, a high back-voltage is required because the small contact area of the tungsten point limits the current to not more than 20 mA. The production of Ge crystals is described briefly and several assembly designs of the unit are shown, using miniature valve-base mountings. See also 3065 of 1948 (Rittner), 264 of January (Bardeen & Brattain), 265 of January (Wells : White) and 582 below.

621.396.645 : 537.311.33 : 621.315.59 **582**

Experimental Data on Germanium Crystal Amplifiers.—S. Y. White. (*Audio Engng, N.Y.*, Oct. 1948, Vol. 32, No. 10, pp. 32–33..52.) An investigation of fundamental properties, undertaken in the unfulfilled hope that well-known valve theory could be widely applied to crystal amplifiers. Unexpected results for untreated crystals were : (*a*) lack of contact control reciprocity for standard 1N34 units ; (*b*) control with negative grid ; (*c*) overshooting to about 500 mA produces increased amplification and stability ; (*d*) lack of heating when passing high currents. Characteristics of crystals treated by overshooting and tapping included : (*a*) increased grid current ; (*b*) reduced anode current; (*c*) reduced anode impedance ; (*d*) constant percentage change in anode current when controlled by the grid current ; (*e*) anode impedance is independent of anode voltage and grid bias ; (*f*) grid impedance is largely affected by the anode circuit conditions. See also 581 above and back references.

621.396.822 **583**

Valve Noise and Transit Time.—N. Houlding. (*Wireless Engr*, Nov. 1948, Vol. 25, No. 302, p. 372.) Comment on 2420 of 1948 (Campbell, Francis & James).

621.396.822 : 621.392 **584**

Some Notes on Noise Theory and its Application to Input Circuit Design.—W. A. Harris. (*RCA Rev.*, Sept. 1948, Vol. 9, No. 3, pp. 406–418.) The mechanism of noise production in a valve is discussed and an equivalent circuit is analysed to determine the optimum noise factor under various conditions. The frequencies corresponding to chosen values of noise factor are given for several types of valve, and circuit requirements for obtaining noise factors approximating to the theoretical values are discussed. See also 2336 of 1942 (Herold).

621.385 : 621.392 **585**

Vacuum Tube Circuits. [Book Review]—Arguimbau. (*See* 355.)

621.385.1 **586**

Dutch Report on Transmitting Tube Targets in Germany. [Book Notice]—B.I.O.S. Miscellaneous Report No. 102. H.M. Stationery Office, London, 54 pp., 4s. 6d. Report of valve production methods and problems at the principal works in Germany in 1947. Some valve types are described ; test methods are outlined and test limits given.

621.385.832 **587**

The Cathode-Ray Tube and Typical Applications. [Book Review]—Allen B. DuMont Laboratories, Clifton, N.J., 1948, 63 pp. (*Proc. Inst. Radio Engrs, W. & E.*, Oct. 1948, Vol. 36, No. 10, p. 1269.) A non-technical discussion, of special value as a reference text for students.

621.396.615.141.2 **588**

Microwave Magnetrons. [Book Review]—G. B. Collins (Ed.). McGraw-Hill, New York, 1947, 769 pp., $9.00. (*Electronics*, Sept. 1948, Vol. 21, No. 9, pp. 228, 230.) Volume 6 of the M.I.T. Radiation Laboratory series. " Upon studying this book, one is impressed with its uniqueness, scope, and general excellence. For a worker in the field of microwave magnetrons it is unquestionably an essential."

MISCELLANEOUS

061.24 : 621.396.1 **589**

J.T.A.C.: Its Purpose and Program.—(*Electronics*, Sept. 1948, Vol. 21, No. 9, pp. 72–75.) The Joint Technical Advisory Committee of 8 engineers has been appointed by the R.M.A. and I.R.E. to advise government bodies and industry on the wise use and regulation of radio facilities.

061.3 : 01 **590**

The Royal Society Scientific Information Conference.—(*Nature, Lond.*, 21st Aug. 1948, Vol. 162, No. 4112, pp. 279–286.) The Conference was organized in 4 sections to discuss methods of improving and rationalizing the arrangements for (*a*) publishing and distributing original scientific papers, (*b*) issuing and using abstracts, (*c*) consolidating abstracts and references into continuously cumulative indexes to assist retrospective searching of the literature, and (*d*) producing and using periodical reviews of progress in specific fields. Summaries of the Conference recommendations for each section are included. See also 597 below.

526.841 **591**

The Construction of Zenithal-Equidistant Maps.—H. T. Mitchell, T. Kilvington & W. E. Thomson. (*P.O. elect. Engrs' J.*, July 1948, Vol. 41, Part 2, pp. 85–91.) These maps give the great-circle bearing, distance and path from their centres to any other point on the earth. Earlier maps of this type were constructed by means of an oblique stereographic graticule for the centre in question. More recently, bearings and distances have been obtained by a graphical/mechanical device, the Navicard, whose use is explained.

621.38/.39 **592**

The Editors Report on Electronics Park.—J. M. (*Electronics*, Oct. 1948, Vol. 21, No. 10, pp. 77–100.) Description of the organization, arrangements and facilities available at this General Electric establishment, which serves as a combined headquarters, engineering establishment and manufacturing plant for electronics.

621.396.97 **593**

The Organisation of Broadcasting in the British Zone of Germany.—H. Carleton Greene. (*B.B.C. Quart.*, Oct. 1948, Vol. 3, No. 3, pp. 129–134.) The broadcasting organization in the British Zone is known as the Nordwestdeutscher Rundfunk (NWDR). It serves nearly 3 500 000 licence holders, is national rather than local in character, and is entirely free from party politics. In the American Zone each Land has its small radio station with local interests and commercial broadcasting is permitted. The French radio is frankly an instrument of French policy and cultural propaganda. In the Russian Zone broadcasting is an instrument of the Socialist Unity Party.

The NWDR consists of four stations with transmitters at Hamburg (100 kW), Langenburg, near Cologne, (100 kW), Hanover (20 kW), Berlin (5 kW; a 20-kW station is about to be installed), Flensburg (2½ kW) and Osnabrück (5 kW). Hamburg and Langenburg are synchronized on 332 m; all the others transmit on 225 m. A s.w. transmitter at Elmshorn broadcasts in the 41-m band.

621.396.97 **594**

Pattern for F.M. Profits: Part 1 — Introduction.—M. McClintock. (*FM & Televis.*, Sept. 1948, Vol. 8, No. 9, pp. 28, 65.) Discussion of Rural Radio Network policy for f.m. operation. F.m. broadcasting can provide new cultural, technical and information services without disturbing existing commercial a.m. broadcasts. See also 494 above.

621.396.97 : 621.396.619.13 **595**

Pattern for F.M. Profits: Part 3 — Promotion.—P. Guterman. (*FM & Televis.*, Sept. 1948, Vol. 8, No. 9, pp. 31–33..64.) Discussion of methods used to explain the possibilities of the Rural Radio Network system to potential listeners. The scale of charges for broadcasting time is given. See also 494 above.

621.396.97 : 621.396.619.13 **596**

Pattern for F.M. Profits: Part 4 — Programming.—R. B. Child. (*FM & Televis.*, Sept. 1948, Vol. 8, No. 9, pp. 34–35.) Rural Radio Network is developing its programme to serve the specific habits and preferences of the audience with special attention to the timing of items such as market prices and local weather reports. A typical programme schedule is given. See also 494 above.

061.3 : 001.89 **597**

[Report of] **Royal Society Empire Scientific Conference, June-July 1946.** [Book Notice]—The Royal Society, London, 1948, Vol. 1, 828 pp., Vol. 2, 707 pp., 42s. (for the 2 vols). (*Nature, Lond.*, 30th Oct. 1948, Vol. 162, No. 4122, p. 679.) Full report of the Conference noted in 3828 of 1946.

061.3(456.3) : 621.396 **598**

Atti del Congresso Internazionale per il Cinquantenario della Scoperta Marconiana della Radio. (Proceedings of the International Conference for the Jubilee of the Discovery of Radio by Marconi.) [Book Notice]—G. Bardi, Rome, 951 pp. Papers read and speeches made at the Conference are published in full, each in the language of its author(s).

41.323.9 : 621.396 **599**

Dictionnaire de Radiotechnique (en trois langues). [Book Review]—M. Adam. Librairie de la Radio, Paris, 700 pp., 530 fr. (*Radio tech. Dig., Édn franç.*, June/Aug. 1948, Vol. 2, Nos. 3/4, p. 183.) The main part serves as a French-English-German lexicon and defines and describes clearly each radio term and its derivatives. The second and third parts are respectively German-French and English-French lexicons giving the equivalents of the 1 500–2 000 words defined in the first part.

621.396 **600**

Radio Engineering: Vol. 1. [Book Review]—E. K. Sandeman. Chapman & Hall, London, 1947, 775 pp., 45s. (*Beama J.*, Aug. 1948, Vol. 55, No. 134, pp. 267–268.) " As a reference book for the man of experience the work is exceedingly good, and even the first eight introductory chapters fall within this category . . . Radar and television are not included, but otherwise the work is virtually a ' bible ' on radio engineering." For another review see *Nature, Lond.*, 8th May 1948, Vol. 161, No. 4097, p. 706.

621.396 (031) **601**

The Radio Amateur's Handbook. [Book Review]—Headquarters Staff of the American Radio Relay League. American Radio Relay League, West Hartford, Conn., 25th edn 1948, 760 pp., $2 in U.S.A., $2.50 elsewhere. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1948, Vol. 36, No. 8, p. 1010; *Wireless World*, May 1948, Vol. 54, No. 5, p. 168.) Most of the material has been completely rewritten and the overall plan of the book has been changed. The number of pages is increased by 30%. V.h.f. is discussed more comprehensively; a table of klystrons has been added to the data on American valves. Previous editions were noted in 1303 and 3385 of 1947.

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

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ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 **602**

References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, Sept. & Nov. 1948, Vol. 20, Nos. 5 & 6, pp. 712–719 & 882–887.) Continuation of 3286 of 1948.

531.49 **603**

Electromechanical Feedback.—J. de Boer & G. Schenkel. (*J. acoust. Soc. Amer.*, Sept. 1948, Vol. 20, No. 5, pp. 641–647.) Describes how a mechanical impedance can be realized electrically.

534 **604**

Sound Transmission and Noise.—A. J. King. (*Nature, Lond.*, 25th Sept. 1948, Vol. 162, No. 4117, pp. 499–501.) Brief details of the papers read at a London Symposium held by the Acoustics Group of the Physical Society.

534.21 **605**

Interactions between a Plate and a Sound Field.—R. D. Fay. (*J. acoust. Soc. Amer.*, Sept. 1948, Vol. 20, No. 5, pp. 620–625.) Discussion of interactions between flexural vibrations in the plate and the sound field in an ambient fluid medium. See also 611 below.

534.21 **606**

Radiation from a Diaphragm Struck Periodically by a Light Mass.—M. Strasberg. (*J. acoust. Soc. Amer.*, Sept. 1948, Vol. 20, No. 5, pp. 683–690.) The radiation consists of a line spectrum with intensity maxima near the resonant frequencies of the diaphragm. The energy in the spectrum lies mainly below a frequency which is twice the reciprocal of the time of contact of the hammer at each impact. Expressions are developed for the efficiency of the system.

534.213 **607**

The Coupling of a Cylindrical Tube to a Half-Infinite Space.—J. W. Miles. (*J. acoust. Soc. Amer.*, Sept. 1948, Vol. 20, No. 5, pp. 652–664.) "The radiation resistance of a semi-infinite space, as seen by a cylindrical tube through an aperture in an infinite plane, is computed." An asymptotic expression for the field at a distance from the aperture is developed, and reflection and transmission coefficients are determined in terms of the radiation admittance. Numerical results are shown graphically for the special case of a circular tube and an infinite slot; these results are compared with those obtained by Rayleigh.

534.213.4 **608**

On the Radiation of Sound into a Circular Tube, with an Application to Resonators.—U. Ingård. (*J. acoust. Soc. Amer.*, Sept. 1948, Vol. 20, No. 5, pp. 665–682.) See 1 of January.

534.23 : 534.321.9 **609**

The Scattering of Ultrasonic Waves in Water by Cylindrical Obstacles.—L. Bauer, P. Tamarkin & R. B. Lindsay. (*J. acoust. Soc. Amer.*, Nov. 1948, Vol. 20, No. 6, pp. 858–868.)

534.231.3 **610**

Acoustic Impedance Matching by Means of Screens.—F. H. Slaymaker & M. E. Hawley. (*J. acoust. Soc. Amer.*, Nov. 1948, Vol. 20, No. 6, pp. 802–807.) For operation in air, transmission increases of 9 db have been obtained by correctly placing suitable screens in front of a crystal transducer. The response curve of a sharply resonant transducer is only slightly modified; its directional characteristics are hardly affected. The results of experiments with woven and perforated screens of different shapes are discussed.

534.24 **611**

Reflection of Sound from Submerged Plates.—W. J. Finney. (*J. acoust. Soc. Amer.*, Sept. 1948, Vol. 20, No. 5, pp. 626–637.) When high-frequency underwater sound strikes a submerged steel plate obliquely, 'non-specular' reflection occurs. The behaviour of this reflection as a function of frequency, plate dimensions and angle of incidence is studied experimentally. See also 605 above.

534.321.9 : 534.373 **612**

Absorption Measurements of Sound in Sea Water.—G. J. Thiessen, J. R. Leslie & F. W. Simpson. (*Canad. J. Res.*, Sept. 1948, Vol. 26, Sec. A, No. 5, pp. 306–312.) The measurements were made with a diverging beam, at frequencies between 0.35 and 2.3 Mc/s. Absorption values are somewhat lower than Richardson's values (3474 of 1940) for fresh water, but conclusive comparison is not possible. Advantages of using long distances are discussed.

534.373 **613**

The Origin of Sound Absorption in Water and in Sea Water.—L. N. Liebermann. (*J. acoust. Soc. Amer.*, Nov. 1948, Vol. 20, No. 6, pp. 868–873.) At frequencies below 100 kc/s the absorption in sea water is about 100 times that in pure water, whereas above 1 Mc/s the absorptions are similar. A possible explanation is given.

534.373 **614**

The Attenuation of Audible Sound in Fog and Smoke.—V. O. Knudsen, J. V. Wilson & N. S. Anderson. (*J. acoust. Soc. Amer.*, Nov. 1948, Vol. 20, No. 6, pp. 849–857.) Measurements in artificial fogs or smoke are in approximate agreement with the theories of Sewell, Epstein and Oswatitsch.

534.373 : 534.321.9 : 546.212 **615**

Ultrasonic Absorption in Water in the Temperature Range 0°-80°C.—Smith & Beyer. (*See* 686.)

534.43 : 621.395.61 **616**

Electron Tube Phonograph Pickup.—H. F. Olson & J. Preston. (*Audio Engng, N.Y.*, Aug. 1948, Vol. 32, No. 8, pp. 17–20.) Description of a pickup in which the stylus is coupled to a valve anode. By using a conical instead of a cylindrical-rod anode, the effective mass and mechanical impedance are very greatly reduced. See also 2624 of 1947 (J. V.).

534.6 **617**

A Comparison of the Rayleigh Disk and the Acoustic Radiometer Methods for the Measurement of Sound-Wave Energy.—J. Hartmann & T. Mortensen. (*Phil. Mag.*, May 1948, Vol. 39, No. 292, pp. 377–394.) The two methods were compared with as high a degree of precision as possible. The results show the methods to be consistent if the constant in the formula for the pressure of sound waves incident normally on a wall has the value 2, a value which has been derived independently by various authors. The value $(1 + \kappa)$ in Rayleigh's second formula thus appears to be incorrect.

534.6 **618**

Reciprocity Calibration of Vibration Probes.—C. T. Morrow. (*J. acoust. Soc. Amer.*, Nov. 1948, Vol. 20, No. 6, pp. 826–829.)

534.612.4 **619**

Reciprocity Calibration of Primary Vibration Standards [transducers].—S. P. Thompson. (*J. acoust. Soc. Amer.*, Sept. 1948, Vol. 20, No. 5, pp. 637–640.) The reciprocity method for absolute calibration is shown to be reliable and accurate up to at least 700 c/s. The design of a set of primary standards is discussed.

534.612.4 **620**

Reciprocity Free Field Calibration of Microphones to 100 kc/s in Air.—I. Rudnick & M. N. Stein. (*J. acoust. Soc. Amer.*, Nov. 1948, Vol. 20, No. 6, pp. 818–825.)

534.75 **621**

The Effect of High Altitude on the Threshold of Hearing.—H. W. Rudmose, K. C. Clark, F. D. Carlson, J. C. Eisenstein & R. A. Walker. (*J. acoust. Soc. Amer.*, Nov. 1948, Vol. 20, No. 6, pp. 766–770.) Measurements at a simulated altitude of 35 000 ft, after correction for changes in the response of the apparatus, show that the shift in the average threshold of hearing is within ± 2.5 db of sound pressure level when the density of the air in the outer and middle ear is decreased to about a quarter of its sea-level value.

534.78 **622**

The Effects of High Altitude on Speech.—K. C. Clark, H. W. Rudmose, J. C. Eisenstein, F. D. Carlson & R. A. Walker. (*J. acoust. Soc. Amer.*, Nov. 1948, Vol. 20, No. 6, pp. 776–786.) Measurements were made at simulated altitudes up to 40 000 ft. Vowels and semivowels show a loss in mean square pressure with altitude roughly proportional to the logarithm of the density ratio, while some consonants are little affected.

534.78 **623**

The Masking of Tones by Repeated Bursts of Noise.—G. A. Miller & W. R. Garner. (*J. acoust. Soc. Amer.*, Sept. 1948, Vol. 20, No. 5, pp. 691–696.) See also 2138 of 1948 (Miller & Taylor).

534.851 **624**

The Light-Pattern Meter.—R. E. Santo. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1948, Vol. 36, No. 11, pp. 1431–1433.) A meter which determines, to within 0.5 db, the amplitudes of sine waves recorded on disks. See also 1985 of 1947 (Hornbostel).

534.851 : 621.395.813 **625**

Simplified Dynamic Noise Suppressor.—C. G. McProud. (*Audio Engng, N.Y.*, Aug. 1948, Vol. 32, No. 8, pp. 22–24 . . 33.) A single reactance valve is connected directly across the magnetic pickup. It provides adequate low-frequency equalization to correct for average recording characteristics. For the original dynamic noise suppressor see 991 of 1947 (Scott) and 932 of 1948 (Scott).

534.88 **626**

Sonic Navigation System.—S. R. Rich & A. H. Rosen. (*Electronics*, Nov. 1948, Vol. 21, No. 11, pp. 92–97.) A hyperbolic navigation system for harbours and channels using under-water a.f. pulses from pairs of transmitters. The correct course can be followed to within 50 yards by audio methods, or more accurately by using meter equipment.

621.395.61/.62 **627**

A 100 kc/s Underwater Magnetostrictive Transducer.—L. Camp, R. Vincent & F. du Breuil. (*J. acoust. Soc. Amer.*, Sept. 1948, Vol. 20, No. 5, pp. 611–615.) A diaphragm is driven by a set of 32 magnetostriction units excited in phase and with amplitudes graded so as to give a half-amplitude width for the main beam of 20°, with secondary lobes 30 db down. The laminations used are of 2 V permendur, magnetized by a half-cycle surge current through the windings. For remanence operation an efficiency of 50% is possible with a maximum driving power of 40 W. See also 628 below.

621.395.61/.62 **628**

Lamination Designs for Magnetostrictive Underwater Electroacoustic Transducers.—L. Camp. (*J. acoust. Soc. Amer.*, Sept. 1948, Vol. 20, No. 5, pp. 616–619.) A theory of lamination design for transducers having a plane piston-like radiating face. Experimental data show how well the theory predicts operating characteristics. See also 627 above.

621.395.61/.62 **629**

Note on the Impedance Variations of an Electro-Acoustic Transducer in a Reflecting Field.—S. Byard. (*Proc. phys. Soc.*, 1st Nov. 1948, Vol. 61, No. 347, pp. 478–480.)

621.395.61 **630**

Phase Characteristics of Condenser Microphones.—F. M. Wiener. (*J. acoust. Soc. Amer.*, Sept. 1948, Vol. 20, No. 5, p. 707.)

621.395.623.8 **631**

New Theater [cinema] **Loudspeaker System.**—H. F. Hopkins & C. R. Keith. (*J. Soc. Mot. Pict. Engrs*, Oct. 1948, Vol. 51, No. 4, pp. 385–398.) A general discussion of the requirements for good reproduction and a description of a double system having a crossover frequency of 800 c/s and using sectoral horns to give a wide angle of coverage at high frequencies.

621.395.625 **632**

The Recording and Reproduction of Sound : Parts 18-22.—O. Read : O. Read & R. Endall. (*Radio News*, Aug.–Dec. 1948, Vol. 40, Nos. 2–6, pp. 49–51 . . 146, 48–49, 56–57, 89, 50–51 . . 158 & 48–50 . . 124.) Part 18 : Factors affecting reproducers at a.f. Part 19: Design data for series and parallel filter networks and constant-resistance networks. Part 20: RC tone control systems. Part 21: a.f. correction. Part 22: Loudspeaker cabinets and baffles. Parts 14-17: 2706 of 1948.

621.395.625 **633**

35-mm Magnetic Recording System.—E. Masterson. (*J. Soc. Mot. Pict. Engrs*, Nov. 1948, Vol. 51, No. 5, pp. 481–488.) Discussion of the design and performance of conversion apparatus to adapt a well-known 35-mm sound recorder for magnetic recording.

621.395.625(083.74) : 621.317.79 : 621.395.813 **634**

Proposed Standards for the Measurement of Distortion in Sound Recording.—(*See* 791.)

621.395.625.3 **635**

Optimum High-Frequency Bias in Magnetic Recording.—G. L. Dimmick & S. W. Johnson. (*J. Soc. Mot. Pict. Engrs*, Nov. 1948, Vol. 51, No. 5, pp. 489–499. Discussion, pp. 499–500.) "An experimental study was made of magnetic tapes and films produced by several manufacturers. The effects of bias current upon the frequency characteristic, the reproducing level, and the harmonic distortion are shown."

621.395.625.3 **636**

Magnetic Field Distribution of a Ring Recording Head.—S. J. Begun. (*Audio Engng, N.Y.*, Dec. 1948, Vol. 32, No. 12, pp. 11–13, 39.) The components of the magnetic field acting on the recording medium are determined graphically; accuracy is adequate.

AERIALS AND TRANSMISSION LINES

621.315 **637**

High-Frequency Polyphase Transmission Line.—C. T. Tai. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1948, Vol. 36, No. 11, pp. 1370–1375.) Formulae for the characteristic impedance of the polyphase transmission line and single-phase multi-wire line are found by the vector potential method.

621.392.26† **638**

Analysis and Performance of Waveguide-Hybrid Rings for Microwaves.—H. T. Budenbom. (*Bell Syst. tech. J.*, July 1948, Vol. 27, No. 3, pp. 473–486.) The rings are considered as re-entrant transmission lines, which are transformed into equivalent T- or lattice-network sections. Determinantal methods of analysis are used. Experimental results obtained from a carefully constructed sample of each of two specific types agree satisfactorily with the theory. Another account noted in 2443 of 1948.

621.392.26† **639**

Theory of Slots in Rectangular Wave-Guides.—A. F. Stevenson. (*J. appl. Phys.*, Jan. 1948, Vol. 19, No. 1, pp. 24–38.) Equations are developed for the field generated in a waveguide of arbitrary section by an assigned tangential electric field in the wall of the waveguide. The analogy with a transmission line is established, detailed formulae being given for the reflection and transmission coefficients and for the voltage amplitude generated in the slot by a given incident wave. The transmission coefficients can in part be calculated simply from energy considerations, and expressions are derived for the conductance of a slot when it is equivalent to a series or shunt element in a transmission line. Guide-to-guide coupling is considered and equations are developed for the voltage amplitudes in the various slots of an array.

621.392.26† **640**

Scattering of Electromagnetic Radiation by a Thin Circular Ring in a Circular Wave Guide.—P. Feuer & E. S. Akeley. (*J. appl. Phys.*, Jan. 1948, Vol. 19, No. 1, pp. 39–47.) The waveguide walls and the ring are assumed to be perfectly conducting. Approximate formulae are obtained for the $TE_{1,1}$ wave which give the scattering cross-section, resonance maximum, and half-width as a function of the width of the ring.

621.392.26† **641**

Remarks on Slow Waves in Cylindrical Guides.—A. A. Oliner. (*J. appl. Phys.*, Jan. 1948, Vol. 19, No. 1, pp. 109–110.) A letter indicating (*a*) a simpler method than that of Pincherle (1 of 1945) or Frankel (22 of 1948) for determining the values of dielectric constants and radii necessary for a given phase velocity, (*b*) the existence of curves which greatly reduce the work of calculation. See also 334 of 1948 (Bruck & Wicher).

621.392.52 : 621.396.662.3 **642**

Low-Pass Filters Using Coaxial Transmission Lines as Elements.—Mode. (*See* 680.)

621.396.67 **643**

Characteristics of Helical Antennas Radiating in the Axial Mode.—J. D. Kraus & J. C. Williamson. (*J. appl. Phys.*, Jan. 1948, Vol. 19, No. 1, pp. 87–96.) A theoretical and experimental investigation of the radiating modes when the helix diameter is $0.2\,\lambda$–$0.5\,\lambda$ and the pitch as high as $0.5\,\lambda$. In the axial mode the helix behaves as a beam aerial and the radiation is nearly circularly polarized; for a given helix this mode can persist over a considerable frequency range. See also 650 below.

621.396.67 **644**

The Conical Dipole of Wide Angle.—P. D. P. Smith. (*J. appl. Phys.*, Jan. 1948, Vol. 19, No. 1, pp. 11–23.) A method of calculating the admittance of dipoles consisting of complete cones whose semi-angles lie between 0° and 90°. The theory uses the orthogonal properties of Legendre functions and their derivatives to make the tangential component of the outside field vanish over the spherical end surfaces of the dipoles and to make the inside and outside fields fit at the boundary sphere. An approximate formula is also developed which agrees reasonably well with that of Schelkunoff for the impedance of a thin conical dipole and with that of Stratton and Chu for the impedance of a spherical radiator.

621.396.67 **645**

Antenna Design for Television and F.M. Reception.—F. A. Kolster. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1948, Vol. 36, No. 11, p. 1363.) Correction to formula in 305 of February.

621.396.67 : 621.392.26† **646**

The Field Surrounding an Antenna in a Waveguide.—J. S. Gooden. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 346–350; summary, *ibid.*, Part I, Oct. 1948, Vol. 95, No. 94, p. 454.) An approximate method is described for obtaining the maximum electric field strength surrounding such an aerial. Formulae are given for the circular guide; results for rectangular waveguides are shown graphically.

621.396.67 : 621.396.97 : 621.396.812.3 **647**

An Antenna for Controlling the Nonfading Range of Broadcasting Stations.—C. L. Jeffers. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1948, Vol. 36, No. 11, pp. 1426–1431.) The aerial consists of two vertical elements, one at ground level and the other directly above it. By altering the ratio of the currents in the two sections the angle above which the radiated energy is a minimum can be varied from 40° to 60°. Theoretical performance was checked by measurements on a scale model,

621.396.671 **648**

Mutual Impedance of Parallel Aerials.—G. Barzilai. (*Wireless Engr*, Nov. 1948, Vol. 25, No. 302, pp. 343–352.) Formulae are given for two vertical aerials of different lengths terminated at a perfectly conducting plane. Sinusoidal current distribution is assumed. Results obtained from the formulae are compared with those obtained by a graphical method of integration. Graphs illustrate the behaviour of a driven aerial with a parasitic element of various lengths. See also 658 of 1948 (Cox).

621.396.671 **649**

Rhombic Aerial Design Chart.—R. H. Barker. (*Wireless Engr*, Nov. 1948, Vol. 25, No. 302, pp. 361–369.) The equation for the angle of elevation at which the gain of the horizontal rhombic aerial is a maximum is solved by a graphical method for the vertical plane containing the major axis. The effects of variation of aerial dimensions, frequency, and height on the relative gain are calculated. The small correction due to the finite conductivity and dielectric constant of the earth is discussed.

621.396.677 **650**

Measured Impedances of Helical Beam Antennas.—O. J. Glasser & J. D. Kraus. (*J. appl. Phys.*, Feb. 1948, Vol. 19, No. 2, pp. 193–197.) The results of measurements at frequencies of 300–500 Mc/s are analysed. The aerials are suitable for wide-band applications. See also 3033 of 1947 (Kraus) and 643 above.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.015.3 : 621.392 **651**

Simple Relations for Calculating Certain Transient Responses.—W. J. Cunningham. (*J. appl. Phys.*, March 1948, Vol. 19, No. 3, pp. 251–256.) The response of a linear transmission system to a step voltage or an impulse is related directly to its steady-state response to a sinusoidal signal of variable frequency. Empirical equations connecting the two responses are given and discussed; they may be expected to be accurate within 25% and are useful in preliminary design work or for checking exact but tedious calculations.

621.3.015.3 : 621.392 **652**

The Exact Solution for the Compensation of Transient Distortion in Networks.—D. C. Espley. (*Onde élect.*, Dec. 1948, Vol. 28, No. 261, pp. 461–462.) Summary only. Brief discussion of a method based on equivalent circuits.

621.3.015.3 : 621.392 **653**

The Transient Response of Damped Linear Networks with Particular Regard to Wideband Amplifiers.—W. C. Elmore. (*J. appl. Phys.*, Jan. 1948, Vol. 19, No. 1, pp. 55–63.) When the response to an applied unit step function consists of a monotonic rise to a final constant value, the delay time and rise time are defined in such a way that they may be simply computed from the Laplace system function of the network. The method is applied to low-pass multi-stage wide-band amplifiers.

621.3.094 **654**

Attenuation and Phase Distortion and their Influence on the Establishment of Television Signals.—G. Fuchs & V. Baranov. (*Onde élect.*, Dec. 1948, Vol. 28, No. 261, pp. 463–466.) Summary only. Formulae for the general solution of problems relating to the transient behaviour of a transmission system are applied first to the case of transmission through a section of coaxial cable and then to a complete transmission system.

621.314.26 : 621.313.3 **655**

Parallel Operation of Aircraft Alternators Using Electronic Frequency Changers.—O. E. Bowlus & P. T. Nims. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 31–38.) Preliminary development work. See also 2178 of 1948.

621.314.3† **656**

Some Fundamentals of a Theory of the Transductor or Magnetic Amplifier.—A. U. Lamm. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 1078–1085.) The combination of the d.c. presaturated reactor with the metal rectifier is studied assuming an idealized magnetization curve. Two typical connections are chosen as examples. Dynamic response and applications to voltage and current regulation are considered. A few German and Swedish references are given.

621.314.6 **657**

The Constancy of Small Rectifiers.—D. G. Tucker & G. F. Machen. (*J. sci. Instrum.*, Nov. 1948, Vol. 25, No. 11, pp. 369–371.) The backward resistance of various types of rectifier is much more variable than the forward resistance, either from one rectifier to another of the same type or as regards change with temperature.

621.318.4.028.4 **658**

Data on the High-Frequency Resistance of Coils.—W. F. Witzig. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 764–769.) From measured resistance values for several coils, an approximate method of determining the resistance of coils wound with flat strip or tubing is derived. Factors affecting resistance are discussed.

621.318.572 **659**

A Tripping Circuit for a Multi-Stage Surge Generator.—E. L. White. (*J. sci. Instrum.*, Sept. 1948, Vol. 25, No. 9, pp. 307–309.) A l.v. impulse is applied to the grid of a thyratron and simultaneously to the sweep circuit of a c.r.o. The thyratron transmits a delayed impulse to an extra sphere in the centre of the first sphere gap of the generator, so that breakdown occurs at any desired instant.

621.318.572 : 539.16.08 **660**

Electronic Counters for Impulses.—P. Naslin & A. Peuteman. (*Rev. gén. Élect.*, Oct. 1948, Vol. 57, No. 10, pp. 417–431.) A decade system of thyratrons is described and many developments from the simple flip-flop circuit are discussed, including the Eccles-Jordan circuit, various binary decade systems and a ring decade system using pentodes. A generalized flip-flop circuit with 5 stable states uses 5 triodes with suitable interconnections. Applications of counters are briefly outlined.

621.319.4 : 621.315.614 : 621.315.59 **661**

The Dielectric Properties of Cellulose Insulation Impregnated with Semiconducting Liquids.—Clark. (*See* 747.)

621.319.4 : 621.315.614.015.5 **662**

The Probable Breakdown Voltage of Paper Dielectric Capacitors.—Brooks. (*See* 748.)

621.319.4(43) **663**

German Radio Capacitors.—S. J. Borgars. (*Electronic Engng*, Nov. 1948, Vol. 20, No. 249, pp. 355–357.) A review of the characteristics and construction of capacitors with paper, ceramic, synthetic-mica, polystyrene, electrolyte or air dielectric. Ceramics are extensively used, with glass or glazed ceramics for terminal seals and chlorinated naphthalene as an impregnant. A 4-gang variable capacitor uses die-cast Mg alloy for the main metal parts, with annular peripheral grooves in the rotor vanes for trimming purposes. In one type of variable capacitor, temperature changes cause equal axial displacements of the rotors and stators, so that the temperature coefficient is low. See also B.I.O.S. final reports Nos. 226, 563, 567, 893 and 1459.

621.392 : 003.62 **664**

Circuit Symbols.—L. H. Bainbridge-Bell. (*Wireless World*, Dec. 1948, Vol. 54, No. 12, pp. 437–438.) A general review of the British Standards Institution publication BS530: "Graphical Symbols for Telecommunications". Arguments in favour of retaining a large number of symbols are put forward. Nine new symbols not appearing in previous editions are explained. See also 2737 of 1948.

621.392.43 **665**

Wide-Band Matching by Means of Several Intermediate Elements.—H. Aberdam. (*Onde élect.*, Dec. 1948, Vol. 28, No. 261, pp. 474–481.) Mathematical analysis shows that matching by means of two intermediate transformers, such as $\lambda/4$ elements, diminishes very considerably the energy losses by reflection in a given frequency band. In a particular example considered, this reduction is about 90% for an octave band of frequencies. This problem has been studied in Germany by O. Zinke (Grundlagen der Breitbandantennenanlagen) and W. Pauls (Berechnung und Aufbau von Breitbandleistungstransformatoren).

621.392.52 **666**

Network Analysis involving Realizable Filter Functions.—D. K. C. MacDonald. (*Phil. Mag.*, Feb. 1947, Vol. 38, No. 277, pp. 115–131.) The evaluation of the integrals obtained from the analysis of the response of a network to a given stimulus is difficult. The problem of the low-pass filter is discussed, and a family of 'physically realizable' filter functions is obtained. Various combinations of this family will give approximations to practical filter functions.

621.396.611 : 537.291 **667**

On the Theory of Electron Beam H.F. Oscillators.—G. Ya. Myakishev. (*Zh. tekh. Fiz.*, Aug. 1948, Vol. 18, No. 8, pp. 1063–1068. In Russian.) An electron beam is subjected to a disturbance between two grids and the propagation of the resulting modulation of the charge density, current and kinetic energy along the beam is investigated mathematically. Discussion of (*a*) propagation of modulation with and without allowance for the interaction of electrons, and (*b*) the case of a beam of finite length, is based on an equation (proposed by Vlasov) determining the distribution of electrons.

621.396.611 : 621.316.729 **668**

Synchronization of Controlled Relaxation Oscillators.—O. I. Butler. (*Phil. Mag.*, July 1948, Vol. 39, No. 294, pp. 518–528.) Harker (3879 of 1938) has shown that synchronization can be realized for the linear-timebase type of oscillator. The phenomena of synchronization are here investigated quantitatively. A method of synchronization materially different from Harker's is shown to be also practicable. A measure of the rigidity of the 'synchronous lock' is obtained which allows the effect of changing conditions of operation to be more definitely assessed.

621.396.611 : 621.396.619.13 **669**

Frequency Modulation of Variable Frequency Oscillators.—N. F. Vollerner. (*Radiotekhnika, Moscow*, July/Aug. 1948, Vol. 3, No. 4, pp. 47–55. In Russian.) 'Howling' RC oscillators are considered and a brief analysis of the operation of a typical circuit is given, with experimental verification.

621.396.611.1 : 621.317.6 **670**

The Response of a Resonant System to a Gliding Tone.—N. F. Barber & F. Ursell. (*Phil. Mag.*, May 1948, Vol. 39, No. 292, pp. 345–361.) The response of an oscillatory system to a tone whose frequency slowly increases or decreases is discussed. The variation of amplitude near resonance depends on a single parameter θ. Such an oscillatory system can be used as a frequency analyser (203 of 1947) whose resolving power is highest if θ has a certain value. Similar results are obtained when a tone of fixed frequency acts upon a resonant system whose natural frequency is slowly changed. See also 671 below.

621.396.611.1 : 621.317.6 **671**

Response of Linear Resonant Systems to Excitation of a Frequency Varying Linearly with Time.—G. Hok. (*J. appl. Phys.*, March 1948, Vol. 19, No. 3, pp. 242–250.) "A general solution of this problem is obtained by means of Laplacian transforms. The resulting complex function is evaluated numerically, and universal response curves are presented in order to facilitate the application of the solution to simple or complicated electrical networks as well as to other resonant systems represented by equivalent networks." See also 670 above.

621.396.611.3 **672**

Parabolic Loci for Two Tuned Coupled Circuits.—S. Chang. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1948, Vol. 36, No. 11, pp. 1384–1388.) Under certain restrictions, the reciprocal of the response function, or its equivalent, leads to parabolic loci in the complex plane. Design methods for coupled circuits are based on the geometry of the parabola.

621.396.611.3 **673**

Coupled Circuits for High and Medium Frequencies.—L. de Valroger. (*Rev. tech. Comp. franç. Thomson-Houston*, Sept. 1948, No. 11, pp. 17–45. In French, with English summary.) A general system of curves is developed which greatly facilitates the determination of the selectivity and phase distortion for a system of coupled circuits with any type of coupling and impedances of any value. The curves can be used for all cases where the pass-band is not excessively large. One such system of curves is particularly useful for the coupled circuits of receivers. Large errors prohibit the use of the curves for the case of very large bandwidths; for this a new method of calculation is given, which gives fairly quickly and without approximations the values of the various impedances of the circuits.

621.396.645 **674**

Fundamental Relations for Transmitter Amplifiers with Wide-Band H.F. Modulation and using Ordinary Valves.—J. Fagot. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 376–378.) Summary only. Formulae for output power and power gain per stage are derived and applied to obtain improved performance of transmitter amplifiers by modification of either the output stage or the intermediate circuits.

621.396.645 **675**

On the Equivalence of H.F. and L.F. Amplifiers.—S. I. Evtyanov. (*Radiotekhnika, Moscow*, July/Aug. 1948, Vol. 3, No. 4, pp. 26–33. In Russian.) Tuned linear amplifiers are considered. The relationship between the instantaneous values of input and output voltage is compared with that between the complex envelopes of these quantities for a h.f. amplifier, taking into account the frequency displacement of the input voltage from the resonance frequency of the amplifier. The condition for a l.f. amplifier circuit to be equivalent to a h.f. amplifier circuit is deduced. Equivalent circuits and transmission coefficients are tabulated for 3 different h.f. circuits. Transient phenomena are discussed.

621.396.645 : 518.4 **676**

Graphical Analysis of Cathode-Coupled Amplifiers.—H. A. Watson. (*Canad. J. Res.*, Aug. 1948, Vol. 26, Sec. F, No. 8, pp. 340–346.) A method of design and gain calculation based on data obtained from the anode characteristic curves. The method can be used to predict performance and to determine the zero-signal operating conditions.

621.396.645 : 621.396.828.1 **677**

Heater Supplies for Amplifier Hum Reduction.—F. W. Smith. (*Audio Engng, N.Y.*, Aug. 1948, Vol. 32, No. 8, pp. 26–27, 35.) The best solution of the hum problem is to use either d.c. or h.f. a.c. for the valve heaters. Typical supply units are described.

621.396.645.36 **678**

The See-Saw Circuit Again.—J. McG. Sowerby. (*Wireless World*, Dec. 1948, Vol. 54, No. 12, pp. 447–449.) Diagrams with explanations of three such circuits are given, together with a set of design curves for the T see-saw and an appendix containing useful formulae. Various applications of these circuits are discussed. See also 2212 of 1948 (Cocking).

621.396.662.3 **679**

Wide Band Crystal Filter for Carrier Program Circuits.—F. E. Stehlik. (*Bell Lab. Rec.*, Nov. 1948, Vol. 26, No. 11, pp. 462–465.) The exacting requirements to be met by such filters are discussed. The filter consists of two complex lattice sections containing crystal elements and two ladder sections containing coils and capacitors. Each lattice section requires 22 crystal elements. Insertion loss and delay distortion characteristics are shown for a filter passing the lower sideband of an 88-kc/s carrier.

621.396.662.3 : 621.392.52 **680**

Low-Pass Filters Using Coaxial Transmission Lines as Elements.—D. E. Mode. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1948, Vol. 36, No. 11, pp. 1376–1383.) Four transmission-line low-pass filter designs are given which specify the mechanical dimensions required for constructing filters with pass-bands as large as 4 000 Mc/s.

621.396.813 : 621.396.645 **681**

On the Reduction of Phase Distortion in Stagger-Tuned Amplifiers.—J. Laplume. (*C. R. Acad. Sci., Paris*, 4th Oct. 1948, Vol. 227, No. 14, pp. 675–677.) All even harmonics will be practically annulled when the resonance frequencies of the different circuits are symmetrical with respect to the mean frequency. For the case of 2 tuned circuits, the third harmonic of the mean frequency can also be eliminated if $B/\Delta = 2\sqrt{3}$, where $\Delta\ (= \frac{1}{2}|\ \eta_2 - \eta_1|)$ is the difference between the mean frequency and that of either of the circuits, and $B(= \eta/Q)$ is the pass band at 3 db. The first harmonic not annulled is thus the fifth. With 3 circuits, both the third and fifth harmonics can be annulled. The first two circuits are again symmetrical with respect to the mean frequency, to which the third circuit is tuned. The pass band B_1 for the first two circuits and that (B_3) for the third should be such that $B_1/\Delta = 2.097$ and $B_3/\Delta = 2.647$. In both cases the amplitude curve is rather rounded. See also 40 of January.

621.397.645 **682**

Pentriode Amplifiers.—H. M. Zeidler & J. D. Noe. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1948, Vol. 36, No. 11, pp. 1332–1338.) Description of two video-amplifier circuits in which the phase-shift and degenerative decrease in gain caused by inefficient screen-grid and cathode by-pass circuits are eliminated throughout the frequency range. Small mica capacitors are used where possible instead of bulky electrolytic ones.

GENERAL PHYSICS

53.081 + 621.3.081 **683**

Units.—(*Bull. Soc. franç. Élect.*, Dec. 1948, Vol. 8, No. 87, pp. 557–581.) Full discussion on 1006 of 1948 (Budeanu) and 1007 of 1948 (Grivet).

53.081 + 621.3.081 **684**

Electromagnetic Units and Definitions.—G. Stedman. (*Wireless World*, Nov. 1948, Vol. 54, No. 11, pp. 406–409.) Discussion of the reasons underlying the changes in accepted standards noted in 2833 and 2834 of 1947.

530.162 : 519.2 **685**

The Restricted Problem of the Random Walk.—A. N. Gordon. (*Phil. Mag.*, July 1948, Vol. 39, No. 294, pp. 572–575.) Comment on 627 of 1944 (Silberstein). A simple solution is proposed which does not involve difference equations. This is then extended to any number of dimensions.

534.373 : 534.321.9 : 546.212 **686**

Ultrasonic Absorption in Water in the Temperature Range 0°–80°C.—M. C. Smith & R. T. Beyer. (*J. acoust. Soc. Amer.*, Sept. 1948, Vol. 20, No. 5, pp. 608–610.) Experimental values for 6 frequencies between 12.25 and 40.50 Mc/s agree with Hall's calculated values (2774 of 1948) within the limits of experimental error.

537.212 : 621.392.029.64 **687**

The Electrical Field of a Point Charge inside a Cylinder, in connection with Wave-Guide Theory.—C. J. Bouwkamp & N. G. de Bruijn. (*J. appl. Phys.*, Jan. 1948, Vol. 19, No. 1, p. 105.) Corrections to 78 of 1948.

537.291 **688**

Graphical Methods for Tracing Electron Trajectories.—R. Musson-Genon. (*Onde élect.*, Dec. 1948, Vol. 28, No. 261, pp. 469–473.) Methods giving results of different orders of approximation are discussed and an accurate method based on Taylor series, including terms of the 4th order, is described, together with a mechanical device with which the necessary determinations can be carried out both quickly and accurately.

537.291 **689**

Possible Fluctuations in Electron Streams due to Ions.—J. R. Pierce. (*J. appl. Phys.*, March 1948, Vol. 19, No. 3, pp. 231–236.) Theory predicts that disturbances in an electron stream containing ions will build up in the direction of electron motion. Experiment shows the existence of oscillations which roughly correspond to the theory.

537.525.029.64 **690**

Electrical Breakdown of a Gas between Coaxial Cylinders at Microwave Frequencies.—M. A. Herlin & S. C. Brown. (*Phys. Rev.*, 15th Oct. 1948, Vol. 74, No. 8, pp. 910–913.) Continuation of 3390 of 1948. Experimental values obtained for the ionization rate between parallel plates are applied to the computation of breakdown voltages of air between coaxial cylinders. Graphs of the values of this voltage as a function of air pressure are obtained, both theoretically and experimentally, for a coaxial cavity resonant for λ 9.6 cm. The agreement is sufficient to justify the original postulates.

538.1 **691**

Methods of Electromagnetic Field Analysis.—S. A. Schelkunoff. (*Bell Syst. tech. J.*, July 1948, Vol. 27, No. 3, pp. 487–509.) A discussion of the fundamental conceptions underlying the application of e.m. field theory to practical systems. The points of contact between field and circuit theory are stressed and the properties of free space, transmission lines, aerials and waveguides are discussed in terms of the field theory. The relationship between Kirchhoff's equations and Maxwell's field equations is indicated, and some differences between a network of lumped elements and a continuous network are explained by means of the complex impedance plane.

538.3.001.572 **692**

Theory of Models of Electromagnetic Systems.—G. Sinclair. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1948, Vol. 36, No. 11, pp. 1364–1370.) Discussion of the conditions necessary so that model measurements can be made on an absolute instead of a relative basis.

538.569.4 **693**

Minimum Detectable Absorption in Microwave Spectroscopy and an Analysis of the Stark Modulation Method.—W. D. Hershberger. (*J. appl. Phys.*, April 1948, Vol. 19, No. 4, pp. 411–419.)

538.69 **694**

On the Influence of a Homogeneous Longitudinal Magnetic Field on Radiation [from Ra-E].—F. Ehrenhaft & R. Herzog. (*C. R. Acad. Sci., Paris*, 27th Sept. 1948, Vol. 227, No. 13, pp. 626–627.) The penetrating power of the radiation from a Ra preparation (mainly Ra-E) on the face of the south pole of an electromagnet was definitely increased by switching on the field. See also 1020 of 1948 (Ehrenhaft).

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

521.15 : 523.7 **695**

On the Angular Momentum of the Sun.—S. Lundqvist. (*Ark. Mat. Astr. Fys.*, 21st Sept. 1948, Vol. 35, Part 3, Section A, No. 27, 6 pp. In English.)

523.72.029.5 : 621.396.822 **696**

The Generation of Radio-Frequency Radiation in the Sun.—M. Ryle. (*Proc. roy. Soc. A*, 12th Nov. 1948, Vol. 195, No. 1040, pp. 82–97.) Under normal conditions the radiation has random polarization, and the minimum intensity observed for frequencies below 200 Mc/s corresponds to a black-body source at about 10^6 °K. When sunspots occur, the intensity increases and corresponds to a source temperature of 10^9 to 10^{10} °K, and the radiation is circularly polarized. The experimental results are considered theoretically, and explained in terms of the acceleration of electrons in the solar atmosphere. Magneto-ionic theory indicates several regions in the solar atmosphere above a sunspot where intense absorption (and therefore intense radiation) occurs. Radiation at the frequency of free gyration of electrons in the magnetic field is intense, but can only travel towards the centre of the sun. A low-altitude high-density region of appreciable absorption coefficient can emit circularly polarized radiation corresponding to that of the ordinary wave of the magneto-ionic theory. A second region, situated at a greater height, absorbs the extraordinary component. Normally the absorption coefficient in this region is insufficient for the radiation to approach the equilibrium intensity, but elevation of prominence material may greatly increase the intensity of the extraordinary radiation so that it predominates.

523.72.029.63/.64 : 621.396.822 **697**

Observation of a Solar Noise Burst at 9 500 Mc/s and a Coincident Solar Flare.—M. Schulkin, F. T. Haddock, K. M. Decker, C. H. Mayar & J. P. Hagen. (*Phys. Rev.*, 1st Oct. 1948, Vol. 74, No. 7, p. 840.) Solar noise bursts at 25, 50, 75, 110, 480 and 9 500 Mc/s were observed on 29th July 1948 simultaneously with the eruption of a very bright solar flare and with the commencement of an ionospheric disturbance. A microwave radiometer with a 10-ft paraboloid aerial, having a beam width of about 0.7°, was used for the observations on 9 500 Mc/s; the aerial temperature readings for the sun rose from about 2 145°K to over 4 000°K within 20 sec. Brief details are given of the personnel and apparatus involved in the other observations.

523.72.029.63 : 621.396.822 : 523.752 **698**

Observation of Remarkable Pertubations of Solar Radiation on Decimetre Waves.—J. Houtgast & M. Laffineur. (*C. R. Acad. Sci., Paris*, 11th Oct. 1948, Vol. 227, No. 15, pp. 717–718.) The continuous record of solar radiation at λ 54.5 cm obtained with the help of a large (7.5-m) parabolic reflector, showed on 17th Sept. 1948 an increase of intensity up to 3 times the normal mean value. The occurrence of this increase coincided with a chromospheric eruption observed at Greenwich. Short-wave communications were interrupted at the same time. Other perturbations occurred during a period of 1½ hours on 4th Oct. 1948.

523.746 " 1749/1948 " **699**

Tables on Sunspot-Frequency for 1749-1948.—E. H. Munro. (*Terr. Magn. atmos. Elect.*, Sept. 1948, Vol. 53, No. 3, pp. 241–246.)

523.746 " 1947 " **700**

Final Relative Sunspot-Numbers for 1947.—M. Waldmeier. (*Terr. Magn. atmos. Elect.*, Sept. 1948, Vol. 53, No. 3, pp. 265–267.)

523.746 " 1948.01/.06 " **701**

Provisional Sunspot-Numbers for January to March [and April to June], **1948.**—M. Waldmeier. (*Terr. Magn. atmos. Elect.*, June & Sept. 1948, Vol. 53, Nos. 2 & 3, pp. 152 & 268.)

523.854 : 621.396.822.029.62 **702**

A New Intense Source of Radio-Frequency Radiation in the Constellation of Cassiopeia.—M. Ryle & F. G. Smith. (*Nature, Lond.*, 18th Sept. 1948, Vol. 162, No. 4116, pp. 462–463.) Discussion of 80-Mc/s observations undertaken primarily to determine the polarization of the radiation from Cygnus (noted in 1926 of 1948) which appears to come from very intense discrete sources. Records are shown for the Cygnus source and the new source, obtained with the two halves of the aerial system about 0.5 km apart and (*a*) parallel or (*b*) mutually perpendicular. As the amplitude of the interference pattern for case (*b*) is only 5% of that for case (*a*), the radiation from both sources is randomly polarized. The radiation is possibly more analogous to that from the quiet sun than to that from sunspots.

538.12 : 521.15 **703**

Magnetic Field produced by the Rotation of a Gravitational Mass with a Volume Electric Charge.—C. Sălceanu. (*C. R. Acad. Sci., Paris*, 27th Sept. 1948, Vol. 227, No. 13, pp. 624–626.) From consideration of dimensions, S. Procopiu (704 below) finds that the ratio P/U in Blackett's formula can be expressed as Q/M, where Q is a quantity of electricity, in e.m. units, and M is a gravitational mass. This expression is here justified theoretically. From Blackett's value of 1.1×10^{-15} for P/U, the value of Q for the earth is found to be 1.32×10^{12} e.m. units, so that the charge per cm^3 has nearly the same numerical value as the surface charge per cm^2. The value of the ratio P/U is not of the same order of magnitude in the case of the spinning electron, because the electric charge is so large in comparison with the mass, but by quantizing the value of the magnetic moment of the rotating electron mass, it can be shown that the electron spin is equal to that of Bohr's magneton and the relation $P/U=Q/M$ holds good also for the electron. See also 3112 of 1947 (Blackett).

538.12 : 521.15 **704**

Magnetic Field of a Rotating Mass.—S. Procopiu. (*Bull. Éc. polyt. Jassy*, Jan./June 1948, Vol. 3, No. 1, pp. 453–458.) Discussion of a formula which represents the magnetism of the earth or the sun just as well as Blackett's formula; it also holds good for the spinning electron. See also 703 above.

550.38 **705**

On the Significance of Geomagnetic Parameters calculated from Observations in a Limited Area.—G. Fanselau. (*Terr. Magn. atmos. Elect.*, June 1948, Vol. 53, No. 2, pp. 163–165.) Summary of paper in *Z. Met.*, 1946, Vol. 1, Nos. 2/3, pp. 55–62. The analytical representation of geomagnetic observations can be performed either by means of a spherical-harmonic series (for the whole earth) or by a simple Taylor series (for a survey covering a limited area). The coefficients (parameters) of the general expansion are shown to be deducible from those of the Taylor series.

550.38 : 05 **706**

Geomagnetic and Geoelectric Literature in Two New German Periodicals.—Macht. (*See* 918.)

550.38 " 1947 " **707**

Five International Quiet and Disturbed Days for [each month of] **the Year 1947.**—W. E. Scott. (*Terr. Magn. atmos. Elect.*, June 1948, Vol. 53, No. 2, p.166.)

550.38 " 1948.01/.06 " **708**

Cheltenham [Maryland] ***K*-Indices for January to March** [and April to June]**, 1948.**—R. E. Gebhardt : P. G. Ledig. (*Terr. Magn. atmos. Elect.*, June & Sept. 1948, Vol. 53, Nos. 2 & 3, pp. 166–167 & 272.)

550.38 " 1948.01/.06 " **709**

***K*-Indices and Sudden Commencements, January to March** [and April to June]**, 1948, at Abinger.**—H. Spencer Jones. (*Terr. Magn. atmos. Elect.*, June & Sept. 1948, Vol. 53, Nos. 2 & 3, pp. 167–168 & 303–304.)

550.384 **710**

The Abnormal Daily Variation of Horizontal Force at Huancayo and in Uganda.—S. Chapman. (*Terr. Magn. atmos. Elect.*, Sept. 1948, Vol. 53, No. 3, pp. 247–250.)

550.384 : 523.73 **711**

Persistent Solar Rotation-Period of 26⅞ Days and Solar-Diurnal Variation in Terrestrial Magnetism.—J. Olsen. (*Terr. Magn. atmos. Elect.*, June 1948, Vol. 53, No. 2, pp. 123–134.)

550.385/.386 **712**

Geomagnetic Activity during 1947 observed at Niemegk.—G. Fanselau. (*Terr. Magn. atmos. Elect.*, June 1948, Vol. 53, No. 2, p. 162.) Summary of paper in *Z. Met.*, 1947, Vol. 1, No. 15, pp. 449–457. Daily tables from March to December 1946. To be published annually in future.

550.385 "1948.01/.06" **713**

Principal Magnetic Storms [Jan.–June 1948].—(*Terr. Magn. atmos. Elect.*, June & Sept. 1948, Vol. 53, Nos. 2 & 3, pp. 172–185 & 321–331.)

551.510.534 **714**

The Ozone Content of the Middle Stratosphere.—R. Penndorf. (*Terr. Magn. atmos. Elect.*, June 1948, Vol. 53, No. 2, pp. 162–163.) Summary of paper in *Z.Met.*, 1947, Vol. 1, Nos. 10/11, pp. 345–357.

551.510.535 **715**

Critical Frequency near $\tau = 1$.—T. L. Eckersley. (*Terr. Magn. atmos. Elect.*, June 1948, Vol. 53, No. 2, pp. 155–161.) The normal and larger critical frequency of the extraordinary ray is in the region where the rays are lost. The extra critical frequency is in the neighbourhood of $\tau = eH/(2\pi m\nu) = 1$, where ν is the frequency. If τ_z is the vertical component of τ, theoretical reasons are given for expecting the extra critical frequency to occur when $\tau_z = 1$. Existing experimental results are not sufficiently accurate to confirm or deny the theory, and further experiments should be undertaken all over the world with adequate power. See also 1282 of 1938 (Martyn & Munro) and 2185 of 1938 (Berkner & Booker).

551.510.535 **716**

A Study of the Ionospheric Data Obtained at Wuchang—Sept. 1946 thru. Dec. 1947.—P. H. Liang, H. L. Lung & S. Wang. (*Chin. J. Phys.*, June 1948, Vol. 7, No. 3, pp. 115–131.) Analysis of routine hourly observations. The diurnal and seasonal variations of ionization density and virtual height are shown graphically for the E, F_1 and F_2 layers, and briefly discussed. Deviations from the normally recognized characteristics are discussed more fully. Sporadic-E ionization and its possible connection with meteors are also considered.

551.510.535 **717**

Magneto-Ionic Measurements at High Latitudes.—J. C. W. Scott. (*Terr. Magn. atmos. Elect.*, June 1948, Vol. 53, No. 2, pp. 109–122.) Discussion of measurements of F_2-layer critical frequencies at Clyde River, Baffin Land, only 8° from the geomagnetic pole. Large diurnal and seasonal variations occur in the magnetic field. In addition to these periodic changes, a drop of 20% in apparent field occurred in February 1946 and persisted till September 1946. The variation of gyro-frequency with height is greater than would be expected from the inverse-cube law. The results are briefly compared with those obtained at Churchill (Manitoba), at Ottawa and at College (Alaska).

551.510.535 : 525.624 **718**

Tides in the Upper Ionosphere.—O. Burkard. (*Terr. Magn. atmos. Elect.*, Sept. 1948, Vol. 53, No. 3, pp. 273–277. In German, with English summary.) Examination of ionospheric critical frequency data for lunar tides has been made by the statistical periodogram method. After eliminating the daily solar variation, a semi-diurnal M_2-tide has been detected. Washington data for 1945 gave an average period of 12.423 solar hours and amplitude 85 kc/s. These correspond to a relative pressure oscillation of 0.034 2 for a height of about 300 km.

551.510.535 : 525.624 **719**

Lunar Tidal Oscillations in the Ionosphere.—E. V. Appleton & W. J. G. Beynon. (*Nature, Lond.*, 25th Sept. 1948, Vol. 162, No. 4117, p. 486.) Analysis of hourly values at Slough of F_2-layer critical frequency and of the height h_m of the maximum F_2-layer ionization. Semi-diurnal lunar variations have been found in both quantities, but they are approximately in antiphase. The lunar diurnal height variations of the F_2 layer are unexpectedly different in phase from the corresponding E-layer height variations. An investigation of h'_{F_2} data indicates a phase maximum at a time intermediate between those found for the E layer and for h_m.

551.510.535 : 621.317.79 **720**

A Panoramic Ionospheric Echo Recorder.—Stoffregen. (*See* 789.)

551.594.13 **721**

Factors Controlling the Atmospheric Conductivity at the Huancayo Magnetic Observatory.—W. D. Parkinson. (*Terr. Magn. atmos. Elect.*, Sept. 1948, Vol. 53, No. 3, pp. 305–317.) Measurements of the density and rate of formation of small, intermediate, and large ions give results in agreement with Gish's theory of atmospheric conductivity variations. See also 1615 of 1941 (Gish & Sherman).

551.594.21/.22 **722**

Photographic Study of Lightning.—J. H. Hagenguth. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 577–583. Discussion, pp. 583–585.) Discussion of apparatus used and characteristics of flashes. See also 1362 of 1948 (Malan & Schonland) and back references.

551.594.22 : 537.521 **723**

Impulse Characteristics of the Ground under Direct Discharges and with Pointed Electrodes.—H. Norinder & G. Petropoulos. (*Ark. Mat. Astr. Fys.*, 21st Sept. 1948, Vol. 35, Part 3, Section A, No. 26, 23 pp. In English.)

551.594.52 (481) **724**

Statistics of Heights of Various Auroral Forms from Southern Norway.—C. Störmer. (*Terr. Magn. atmos. Elect.*, Sept. 1948, Vol. 53, No. 3, pp. 251–264.) Analysis of the results noted in 1785 of 1947.

LOCATION AND AIDS TO NAVIGATION

534.88 **725**

Bearing Deviation Indicator for Sonar.—O. H. Schuck, C. K. Stedman, J. L. Hathaway & A. N. Butz, Jr. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 1285–1295.) A review of the development of American asdic methods for submarine location. Switched or split-beam techniques using time-delay or sum-and-difference methods of comparison are described. Block diagrams of apparatus are given, with circuit details.

534.88 **726**

Submarine Detection by Sonar.—A. C. Keller. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 1217–1230.) See also 2427 of 1947.

534.88 **727**

Sonic Navigation System.—Rich & Rosen. (*See* 626.)

621.396.9 **728**

Using Air-Borne Radar to Increase Airline Safety.—R. W. Ayer. (*Trans Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 1387–1395.) General discussion of requirements and of existing equipment for avoiding hills, other aircraft, dangerous storms etc.

621.396.932 : 621.396.9 **729**

Radar Eyes bring Safety to Fog-Bound Liverpool.—R. W. Hallows. (*Radio-Electronics* [hitherto *Radio Craft*], Dec. 1948, Vol. 20, No. 3, pp. 22–23.) See also 3415 of 1948.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788 **730**

A Combined Thermocouple and Cold Cathode Vacuum Gauge.—R. I. Garrod & K. A. Gross. (*J. sci. Instrum.*, Nov. 1948, Vol. 25, No. 11, pp. 378–383.) Design, construction and performance details of a vacuum gauge having 2 elements in a common envelope. Pressures in the range 10^{-1}–10^{-3} mm Hg are measured by a thermocouple gauge, and in the range 10^{-3}–10^{-5} mm Hg by a cold-cathode discharge gauge which has a simple device for initiating the discharge at low pressures. The cause of the 'reversal effect', common in thermocouple gauges, is also investigated.

531.788.7 **731**

An Investigation on Hot-Wire Vacuum Gauges : Part 2.—H. von Ubisch. (*Ark. Mat. Astr. Fys.*, 21st Sept. 1948, Vol. 35, Part 3, Section A, No. 28, 12 pp. In English.) Part 1 : 436 of 1948.

535.37 **732**

Emission Spectra of Some Zinc Sulfide and Zinc-Cadmium Sulfide Phosphors.—W. H. Byler. (*J. opt. Soc. Amer.*, Nov. 1947, Vol. 37, No. 11, pp. 920–922.) Spectra of 30 such phosphors with varied Cd content and different activators are shown. These spectra suggest that the emission spectrum is not one broad band, but is the sum of contributions from a number of individual bands whose peak positions are invariant and characteristic of the base material rather than the activator. See also 734 below.

535.37 **733**

Temperature Dependence of the Emission Bands of Zinc Oxide Phosphors.—F. H. Nicoll. (*J. opt. Soc. Amer.*, Sept. 1948, Vol. 38, No. 9, p. 817.) In the temperature range 25°–250°C, the peak in the ultraviolet energy spectrum shifts about 1.2 Å per °C toward longer wavelengths, while the peak in the visible range shows no change.

535.37 **734**

Emission Spectra of Zinc Cadmium Sulfides.—F. J. Studer & D. A. Larson. (*J. opt. Soc. Amer.*, May 1948, Vol. 38, No. 5, pp. 480–481.) Comment on 732 above. Byler's results appear to differ from those of other workers. The reason for this is not fully understood; it may be due to the photographic method used by Byler.

535.37 : 535.61-15 **735**

Infra-Red Stimulability of $CaSiO_3$:Pb and $CaSiO_3$: (Pb + Mn).—J. H. Schulman, R. J. Ginther & L. W. Evans. (*J. opt. Soc. Amer.*, Sept. 1948, Vol. 38, No. 9, pp. 817–818.) Infra-red response, extending from 0.85 μ to 1.3 μ, was observed in the case of both phosphors after excitation by a low-pressure Hg-vapour lamp emitting 1849-Å radiation.

546.16 : 679.5 **736**

The Development of Fluorine Chemistry.—H. J. Emeléus. (*Endeavour*, Oct. 1948, Vol. 7, No. 28, pp. 141–147.) Discussion of new techniques and polymer production.

548.5 **737**

New Crystals for Infrared Spectrometry.—(*J. Franklin Inst.*, Sept. 1948, Vol. 246, No. 3, pp. 249–250.) A crystal containing about 42% TlBr and 58% TlI has been grown at the National Bureau of Standards. Methods of grinding and polishing such soft crystals have been developed and a prism with faces $1\frac{3}{4}$ inch by $2\frac{1}{2}$ inch and refracting angle of 26° has been made. This prism extends the wavlength range of an infra-red spectrometer to 40 μ. See also 2662 of 1948 (Chasmar).

549.514.51 **738**

A Determination of the Elastic Constants for Beta-Quartz.—E. W. Kammer, T. E. Pardue & H. F. Frissel. (*J. appl. Phys.*, March 1948, Vol. 19, No. 3, pp. 265–270.)

621.3(54) : [620.193 + 620.197 **739**

Electrical Engineering Problems in the Tropics.—R. Allan. (*G.E.C. J.*, Oct. 1948, Vol. 15, No. 3, pp. 160–171.) Reprint of 2816 of 1948.

621.315.59 **740**

The Physics of Electronic Semiconductors.—G. L. Pearson. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 209–214.) Present theories are outlined and correlated with quantitative experimental data obtained with typical materials.

621.315.59 : 535.61-15 : 621.383 **741**

The Effect of Room-Temperature Radiation on the Infra-Red Response of Lead Telluride Photoconductors.—O. Simpson. (*Proc. phys. Soc.*, 1st Nov. 1948, Vol. 61, No. 347, pp. 486–487.)

621.315.59 : 546.289 **742**

Non-Rectifying Germanium.—W. C. Dunlap, Jr, & E. F. Hennelly. (*Phys. Rev.*, 15th Oct. 1948, Vol. 74, No. 8, p. 976.) Ge powder, obtained by reduction of

GeO_2 in a hydrogen furnace, was melted at a pressure of less than 10^{-4} mm Hg. The Ge thus obtained had practically no surface-rectification at a contact with metal. The rectification characteristics at 25°C and −196°C are shown graphically. It is suggested that the effect may either be intrinsic (not a result of inhomogeneity), or due to inhomogeneity on a scale small compared with the diameter of the point contact (0.000 2 inch).

621.315.61 **743**

Effect of Moisture Content on the Dielectric Properties of some Solid Insulating Materials at U.H.F.—S. K. Chatterjee. (*Indian J. Phys.*, June 1948, Vol. 22, No. 6, pp. 259–264.) Variations of dielectric constant and power factor with moisture content of ebonite and fibre at frequencies from 214 to 750 Mc/s are discussed.

621.315.61 : 549.623.5 **744**

Electrical Properties of Indian Mica: Part 3 — The Effect of Pre-Heating.—P. C. Mahanti & S. S. Mandal. (*Indian J. Phys.*, Jan. 1948, Vol. 22, No. 1, pp. 7–13.) The power factors of Bengal ruby and Madras green muscovite micas of various qualities have been measured after treatment at various temperatures. Heat treatment for $\frac{1}{2}$ hr at 200°C gives a minimum power factor.

621.315.612 : 546.431.82 **745**

Theory of the Dielectric Behavior of $BaTiO_3$.—J. M. Richardson & B. T. Matthias. (*Phys. Rev.*, 15th Oct. 1948, Vol. 74, No. 8, pp. 987–988.)

621.315.612 : 546.431.82 **746**

Dielectric Behavior of Single Domain Crystals of $BaTiO_3$.—G. C. Danielson, B. T. Matthias & J. M. Richardson. (*Phys. Rev.*, 15th Oct. 1948, Vol. 74, No. 8, pp. 986–987.)

621.315.614 : 621.315.59 : 621.319.4 **747**

The Dielectric Properties of Cellulose Insulation Impregnated with Semiconducting Liquids.—F. M. Clark. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 55–62. Discussion, pp. 62–63.) The abnormalities are described and discussed, and test results given. A new permalytic type of l.v. capacitor using semiconducting impregnated paper is considered.

621.315.614.015.5 : 621.319.4 **748**

The Probable Breakdown Voltage of Paper Dielectric Capacitors.—H. Brooks. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 1137–1144. Discussion, pp. 1144–1145.) Statistical evidence shows that large conducting particles may exist in the paper and bridge one or more layers, through chance orientation during manufacture. The probable voltage strength for a typical grade of paper is calculated.

621.318.2 **749**

Permanent Magnets.—J. L. Salpeter. (*J. Brit. Instn Radio Engrs*, Sept./Oct. 1948, Vol. 8, No. 5, pp. 211–249.) Reprint of 3935 of 1947.

621.318.22 + 621.318.32 **750**

Magnetic Materials.—G. FitzGerald-Lee. (*Electronic Engng*, Nov. 1948, Vol. 20, No. 249, pp. 351–353.) Brief details of modern materials suitable for various applications.

621.318.32 **751**

Hiperco — A Magnetic Alloy.—J. K. Stanley & T. D. Yensen. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 714–718.) Mechanical and electrical characteristics are shown graphically. The effect of heat treatment and of composition variation is discussed. See also 3946 of 1947.

621.318.32 : 621.317.44 **752**

Study of Metals at High Frequencies with the Aid of Permeameters with Demountable Coils.—I. Épelboïm. (*Onde élect.*, Nov. 1948, Vol. 28, No. 260, p. 444.) Corrections to 147 of January.

621.775.7 : 061.3 **753**

First International Powder Metallurgy Conference.—(*Metallurgia, Manchr*, Aug. 1948, Vol. 38, No. 226, pp. 227–230.) A brief report, with short accounts of some of the papers presented. These are to be published in their original languages, with summaries in English or German, by the Austrian Chemical Society. See also 123 of January.

621.793 **754**

Metallizing — A Versatile Method for Production and Maintenance Work.—J. E. Wakefield. (*Materials & Methods*, Sept. 1948, Vol. 28, No. 3, pp. 86–90.) A review of modern methods, with discussion of properties of sprayed deposits. Applications include 'printed' circuits.

669.14 : 538.221 **755**

On the Variation of A.C. Permeability of Transformer Sheet Steels with D.C. Magnetization.—B. M. Banerjee. (*Indian J. Phys.*, June 1948, Vol. 22, No. 6, pp. 265–275.) Experiments show that the inverse of a.c. permeability at constant a.c. flux density varies almost linearly with the d.c. magnetization. Oscillograms of the hysteresis loops show that they are symmetrical and that the tips of the loops are bent towards the H-axis ; the bending increases with d.c. magnetization.

669.14-41 : 538.221 **756**

Magnetic Sheet Steel.—D. Edmundson. (*Engineer, Lond.*, 10th Sept. 1948, Vol. 186, No. 4833, pp. 269–271.) A review of the present position in Britain, with special reference to steel for transformers and rotary machines. The properties of cold-rolled anisotropic steel and hot-rolled sheet steel with controlled impurities and grain size are compared with regard to their use in transformers. Losses in induction motors can be reduced by annealing stampings to remove damage caused by punching. Annealing is particularly useful in the case of small machines and can also be used to assist grain growth and for carburization.

MATHEMATICS

517.63 **757**

Application of the Laplace Transform in the Solution of Linear Integral Equations.—L. B. Robinson. (*J. appl. Phys.*, March 1948, Vol. 19, No. 3, pp. 237–241.) Most of the operations used are illustrated by means of a solution of Abel's integral equation. Results obtained are compared with those of other authors.

518.5 **758**

An Electronic Differential Analyzer.—J. S. Koehler. (*J. appl. Phys.*, Feb. 1948, Vol. 19, No. 2, pp. 148–155.) The device will solve ordinary nonlinear non-homogeneous differential equations. It is based on the relation between charge on a capacitor in a series resonant circuit and time, which is expressed by a linear second-order differential equation. The desired variations of the coefficients are obtained from a variable voltage generator whose output can be made to vary with time in accordance with any given curve. The solution is given on an oscillograph, with an accuracy within 4%.

518.5 **759**

Electronic Digital Computers.—F. C. Williams & T. Kilburn. (*Nature, Lond.*, 25th Sept. 1948, Vol. 162, No. 4117, p. 487.) A small experimental 'universal' machine consisting essentially of (*a*) a store for information and orders, (*b*) various arithmetical organs, such as adders and multipliers, and (*c*) a control unit. The minimum set of facilities is provided, namely: (i) if x is any number in the store, $-x$ can be written into a central accumulator A, or x can be subtracted from what is in A, (ii) the number A can be written in an assigned address in the store, (iii) the content of A can be tested as to whether $x \geqslant 0$ or $x < 0$; if $x < 0$ the order standing next in store is passed over, (iv) control can be shifted to an assigned order in the table, (v) the machine can be ordered to stop. The present store has only a capacity of 32 words, each of 31 binary digits, and only simple arithmetical testing routines have been carried out.

518.5 : 512.25 **760**

An Electronic Simultaneous Equation Solver.—E. A. Goldberg & G. W. Brown. (*J. appl. Phys.*, April 1948, Vol. 19, No. 4, pp. 339–345.) A number of high-gain amplifiers are interconnected by networks whose elements bear definite relationships to the known coefficients of the system of equations. See also 420 of February (Goldberg).

519.271 **761**

Systematic Sampling [of sequences of quantitative values].—F. Yates. (*Philos. Trans.*, 14th Sept. 1948, Vol. 241, No. 834, pp. 345–377.) New methods are evolved for estimating the systematic sampling error from short sections of sequences. Errors due to trend can be eliminated by means of end-corrections. The performance of systematic sampling is investigated theoretically for several functions and for some numerical sequences. The procedure to be adopted for material containing periodicities is discussed.

MEASUREMENTS AND TEST GEAR

531.764.5 **762**

The Evolution of the Quartz Crystal Clock.—W. A. Marrison. (*Bell Syst. tech. J.*, July 1948, Vol. 27, No. 3, pp. 510–583. Bibliography, pp. 583–588.) A comprehensive review of (*a*) early methods and apparatus for timekeeping, and (*b*) the development of quartz oscillators of ever greater absolute frequency constancy and their incorporation in accurate time standards. Methods of comparing the performance of quartz clocks of the highest accuracy are described. Applications of such clocks and their future possibilities are discussed.

534.612.4 : 621.395.61.089.6 **763**

Microphone Calibrator.—D. H. Bastin. (*Electronics*, Nov. 1948, Vol. 21, No. 11, pp. 106–109.) An instrument giving automatically a paper record of the frequency response or polar diagram of a microphone. The response from 30 to 1 000 c/s is measured in a long sound-absorbing tube. Above 1 000 c/s the measurements are made in an ordinary room; pulse methods enable the record to be made before interfering waves reflected from the walls can affect the apparatus. Logarithmic amplifiers are used.

621.317.011.5 : 621.315.618 **764**

Measurements of Dielectric Constant and Dipole Moment of Gases by the Beat-Frequency Method.—J. G. Jelatis. (*J. appl. Phys.*, April 1948, Vol. 19, No. 4, pp. 419–425.)

621.317.3.088 **765**

The Effect of Waveform on the Accuracy of Rectifier Type Instruments.—A. Cunliffe. (*J. sci. Instrum.*, Sept. 1948, Vol. 25, No. 9, pp. 306–307.) Formulae are derived which show the way in which r.m.s. and full-wave rectifier-type a.c. instruments disagree when they are used with a waveform consisting of a fundamental plus a harmonic of order n. With the worst possible phasing conditions, the disagreement is a first-order effect if n is odd and a second-order effect if n is even.

621.317.332 **766**

Metal Optics at Centimetre Wave-Lengths: Part 1.—L. Speirs. (*Phil. Mag.*, Feb. 1948, Vol. 39, No. 289, pp. 105–116.) Theoretical discussion of two methods for investigating surface resistance of thin metal films at λ 1.25 cm. In the first method, a guided wave passes through the film and its support, and reflection and transmission coefficients are derived from direct measurement of reflected and transmitted waves; in the second method a resonant cavity is loaded with the film and the resonance frequency is measured before and after insertion.

621.317.34 **767**

A Highly-Selective Transmission Measuring Equipment for 12- and 24-Channel Carrier Systems.—D. G. Tucker & J. Garlick. (*P.O. elect. Engrs' J.*, Oct. 1948, Vol. 41, Part 3, pp. 166–169.) The general principle of the system was discussed in 3181 of 1947 (Tucker).

621.317.35 : 621.396.619.16 : 621.396.813 **768**

Distortion in a Pulse Count Modulation System.—A. G. Clavier, P. F. Panter & D. D. Grieg. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 989–1004. Discussion, p. 1005.) Full paper. Summary noted in 2281 of 1948.

621.317.37 : 621.365.92 **769**

Dielectric Heating — The Measurement of Loss under Rising Temperature.—J. B. Whitehead. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 947–949.)

621.317.372 **770**

Measurement of High-Q Cavities at 10 000 Mc/s.—R. W. Lange. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 161–166.) Possible methods are discussed, and the 'heterodyne decrement' method is described in detail. An u.h.f. pulse is applied to the cavity and the decay observed by means of a crystal mixer to which a standard beat frequency is also applied; the crystal then behaves as a linear modulator and an exact knowledge of its characteristic is therefore unnecessary.

621.317.384 **771**

Some Aspects of the Theory of Iron-Testing by Wattmeter and Bridge Methods.—N. F. Astbury. (*J. Instn elect. Engrs*, Part II, Oct. 1948, Vol. 95, No. 47, pp. 607–616; summary, *ibid.*, Part I, Sept. 1948, Vol. 95, No. 93, p. 406.) The limitations of the dynamometer are discussed, with special reference to eddy-current, circuit phase-angle and loss compensation, leakage flux and harmonic distortion. Null methods are outlined and a new circuit is given. Discussion of bridge methods is based on the concept of complex permeability and a method of eliminating copper losses is described. A distortion coefficient is defined.

621.317.431 **772**

A 60-Cycle Hysteresis Loop Tracer for Small Samples of Low-Permeability Material.—D. E. Wiegand & W. W. Hansen. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 119–131. Discussion, pp. 131–133.) The basic components are: (*a*) a large (35-lb) exciting coil with a pickup coil at its centre, (*b*) an amplifier and integrating circuit, (*c*) a c.r.o.

621.317.431 : 621.317.755 **773**

Quantitative Determination of Magnetic Properties by Use of Cathode-Ray Oscilloscope.—J. Zamsky. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 783–787.) A detailed description of a method of displaying hysteresis loops on a c.r.o.

621.317.44 : 621.318.32 **774**

Study of Metals at High Frequencies with the Aid of Permeameters with Demountable Coils.—I. Épelboïm. (*Onde élect.*, Nov. 1948, Vol. 28, No. 260, p. 444.) Corrections to 147 of January.

621.317.6 : 534.232 : 681.85 **775**

Vibrators for Measurement of Response and Compliance of Phonograph Pick-Ups.—H. A. Pearson, R. W. Carlisle & H. Cravis. (*J. acoust. Soc. Amer.*, Nov. 1948, Vol. 20, No. 6, pp. 830–833.)

621.317.6 : 621.396.611.1 **776**

The Response of a Resonant System to a Gliding Tone.—Barber & Ursell. (*See* 670.)

621.317.6 : 621.396.645.012 **777**

Very-Wide-Band Response-Amplitude Curve Tracer.—M. A. Jullien. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 388–390.) Summary only. The general conditions which such equipment should satisfy are stated and possible types, with different methods of f.m., are discussed. A new curve tracer, developed in the C.F.T.H. laboratories, is described. This has a frequency excursion continuously adjustable from 0 to 200 Mc/s, the mean frequency being independently adjustable between 2 Mc/s and 1 100 Mc/s. The apparatus uses the beats between a reflex klystron, oscillating in the 3-cm band, and a positive-grid triode with Lecher-line anode circuit operating at wavelengths around 9 cm. The signal output level is of the order of 0.1 V. Operation is described in detail; a diagram shows the arrangement of the various parts.

621.317.715.5 **778**

New Method of Increasing the Voltage Sensitivity of Moving-Coil Galvanometers.—J. Coursaget. (*C. R. Acad. Sci., Paris*, 4th Oct. 1948, Vol. 227, No. 14, pp. 673–675.) An arrangement applicable to any galvanometer is described, which enables the e.m. damping to be reduced while maintaining the original flux, so that a very high voltage sensitivity can be reached. The oscillation period can also be reduced. In a particular case the period was reduced from 8.5 to 5 sec and the critical resistance from 250 to 30 Ω, while the sensitivity was increased from 7.0×10^{-8} to 0.8×10^{-8} V/m at 1 m. See also 1085 of 1948 (Dupouy).

621.317.725 **779**

A Range of Kilovoltmeters for High D.C. Voltages [up to 500 kV].—F. W. Waterton. (*J. sci. Instrum.*, Sept. 1948, Vol. 25, No. 9, pp. 304–306.) Each voltmeter comprises an oil-immersed voltage divider, with either an e.s. indicator or a microammeter and very high resistance connected between one end and a tapping point. Errors in indication are caused by the voltage/resistance and temperature/resistance characteristics of the units used in constructing the divider. These units should all be of the same make and have the same nominal value.

621.317.725.027.7 **780**

Absolute Measurement of High Voltages by Oscillating Electrode Systems.—E. Bradshaw, S. A. Husain, N. Kesavamurthy & K. B. Menon. (*J. Instn elect. Engrs*, Part II, Oct. 1948, Vol. 95, No. 47, pp. 636–641. Discussion, pp. 641–644. Summary *ibid.*, Part I, Sept. 1948, Vol. 95, No. 93, p. 411.) Full paper; summary noted in 2561 of 1948.

621.317.726.089.6 **781**

The Calibration of Ignition Crest Voltmeters.—W. L. Davis & C. E. Warren. (*Trans. Amer. Inst. elect. Engrs*, 947, Vol. 66, pp. 99–104. Discussion, p. 104.) Discussion of circuits and techniques for producing consistent voltage waveforms adjustable over a considerable range of peak voltage, rise time and repetition rate, in order to investigate discrepancies between various types of voltmeter.

621.317.727 : 518.5 **782**

Potentiometers for Computing Circuits.—R. W. Williams. (*Electronic Engng*, Nov. 1948, Vol. 20, No. 249, pp. 358–360.) The error introduced by loading is discussed and illustrated by a numerical example. Temperature effects and potentiometers with graded windings are also considered.

621.317.728 **783**

A Note on the Measurement of Short-Duration Recurrent Voltage Impulses by means of Spark Gaps.—R. Cooper. (*J. Instn elect. Engrs*, Part II, Aug. 1948, Vol. 95, No. 46, pp. 378–382; summary, *ibid.*, Part I, Sept. 1948, Vol. 95, No. 93, p. 404.) The calibration data noted in British Standards Institution publication B.S. 358:1939 for 2-cm spheres can be used for recurrent pulses of duration as short as 0.1–4 μs. The breakdown voltage of the gaps was found to be independent of both pulse duration and recurrence rate if the gap was irradiated by 0.2 mg of Ra. For gaps between parallel-plate electrodes more than 2 mm apart, such irradiation did not affect the breakdown voltage for 1-μs pulses with a repetition rate of 400 per sec.

621.317.733 : 621.3.083.4 **784**

Electronic Null Detectors for Use with Impedance Bridges.—H. W. Lamson. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 535–540.)

621.317.733 : 621.317.738 **785**

A Self Balancing Capacitance Bridge.—A. H. Foley. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 797–801.) Intended for testing mass-produced capacitors, scale indication being in the form of percentage deviation from the proper value. Accuracy claimed is about 0.1% over a capacitance range of 1000 : 1. A servomechanism balances the bridge in about 2 sec.

621.317.733 : 621.392.26† **786**

A Waveguide Bridge for Measuring Gain at 4 000 Mc/s.—A. L. Samuel & C. F. Crandell. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1948, Vol. 36, No. 11, pp. 1414–1418.) The equipment is described and methods of reducing possible errors are discussed. The general method can be adapted for use in any desired frequency range.

621.317.761 : 621.3.015.33 **787**

A Pulse Deviation Meter.—D. I. Lawson & E. R. Rout. (*J. sci. Instrum.*, Sept. 1948, Vol. 25, No. 9, pp. 309–311.) The full-scale reading of the most sensitive range corresponds to unit variation in pulse recurrence frequencies between 10 000 and 30 000 per sec. The deviation of either the leading or the trailing edge of the pulse trains can be measured.

621.317.7 **788**

Advancements in the Design of Long-Scale Indicating Instruments.—R. M. Rowell & N. P. Millar. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 155–160.) For another account see 3173 of 1948.

621.317.79 : 551.510.535 **789**

A Panoramic Ionospheric Echo Recorder.—W. Stoffregen. (*Terr. Magn. atmos. Elect.*, Sept. 1948, Vol. 53, No. 3, pp. 269–271.) A frequency sweep of 1.4–14 Mc/s is made in 3–5 sec and the complete curve of equivalent height versus frequency is displayed on a long-afterglow c.r. tube. Height and frequency calibration marks are included in the picture.

621.317.79 : 621.315.2 **790**

Pulse Echo Measurements on Telephone and Television Facilities.—L. G. Abraham, A. W. Lebert, J. B. Maggio & J. T. Schott. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 541–548. Discussion, p. 548.) See 2295 of 1948.

621.317.79 : 621.395.813 : 621.395.625(083.74) **791**

Proposed Standards for the Measurement of Distortion in Sound Recording.—(*J. Soc. Mot. Pict. Engrs*, Nov. 1948, Vol. 51, No. 5, pp. 449–466. Discussion, p. 467.) Draft proposals under consideration by a subcommittee of the American Standards Association Committee on Standards for Sound Recording.

621.317.79 : 621.396.615.12 **792**

Design of a Continuously Variable Audio Signal Generator.—B. Bauer. (*Audio Engng, N.Y.*, Nov. 1948, Vol. 32, No. 11, pp. 15–17 . . 43.) A stable, accurate unit for testing high-quality audio apparatus. Full circuit details are included.

621.317.79 : [621.396.615.14 + 621.396.621 (083.74) **793**

Standard Receiver and Generator for Ultra-High Frequencies.—R. Cabessa & G. Phélizon. (*Onde élect.*, Nov. & Dec. 1948, Vol. 28, Nos. 260 & 261, pp. 423–432 & 482–486.) An account of two instruments developed at the Laboratoire Central de Télécommunications specially for u.h.f. measurements on receivers, transmitters and aerials. Some details are given of v.m. valves of a coaxial type with high frequency stability and low signal/noise ratio. Simultaneous variation of the cavity tuning and the capacitive coupling is effected by axial adjustment of the central conductor. One of these valves covers the wavelength range 15–30 cm, a second 8–15 cm and a third 6–8 cm. The standard generator gives signals of wavelength from 6 to 30 cm, with square-wave a.m. up to 100%, output power adjustable continuously from 1 μW to 10^{-4} W, and direct reading for receiver noise factor. The wavelength range of the standard receiver is at present 10–15 cm; this will shortly be extended to 6–30 cm. Its use for the following measurements is explained: (*a*) sensitivity of receivers, (*b*) signal/noise ratio of a modulated transmitter, (*c*) tracing of aerial radiation diagrams, and (*d*) absolute measurement of field strength.

621.317.79 : 621.396.822 **794**

A Direct-Reading Instrument for the Measurement of Noise Factor, and Its Application to the Testing of Microwave Mixer Crystals.—L. A. G. Dresel, L. A. Moxon & E. E. Schneider. (*J. sci. Instrum.*, Sept. 1948, Vol. 25, No. 9, pp. 295–298.) The signal generator is a noise source using a coaxial-line temperature-limited diode; the mean amplitude of the noise is substantially square-wave, modulated at 50 c/s. This is fed into the mixer of a conventional receiver. An a.g.c. system is used to hold the maximum receiver output constant. The difference between the maximum and minimum receiver outputs is then read as a 50-c/s voltage, on an indicator which can be calibrated in terms of noise factor.

621.317.79 : 621.397.62.001.4 **795**

Note on Television Test Equipment.—Kniazeff. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 391–394.) Summary only. Reasons are given for the use of square-wave pulses, and apparatus suitable for testing the various circuits of television receivers is discussed.

621.396.69.001.4 : 621.396.621 **796**

Selecting Components for Broadcast Receivers.—G. D. Reynolds. (*Electronic Engng*, Oct. 1948, Vol. 20, No. 248, pp. 307–313.) Long summary of I.E.E. paper. Mechanical, electrical and chemical tests are considered. There are three kinds of each: measurements, life tests, and peak-load or overload tests. The design of test equipment is discussed in the light of the limitations of both the component (or raw material) and the methods of test available, and specific examples are mentioned.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

535.336.2.05 : 621.389 **797**

Radio-Frequency Mass Spectrometer.—(*Electronics*, Nov. 1948, Vol. 21, No. 11, pp. 124, 126.) Positive or negative ions formed near the cathode of a valve are accelerated into a r.f. field which is varied in frequency and amplitude so that only ions of one particular mass pass to the anode.

535.61-15 **798**

The Infra-Red Image Converter Tube.—T. H. Pratt. (*Electronic Engng*, Sept. & Oct. 1948, Vol. 20, Nos. 247 & 248, pp. 274–278 & 314–316.) Operating principles are discussed, developments in Europe and in America are outlined and the special features of the German A.E.G. tube, various R.C.A. tubes and the English E.M.I. (Electric and Musical Industries) tube are described. The E.M.I. tube represents the best compromise between performance and complexity in the applications for which it was originally intended. Its pyrex envelope is only 5 cm in diameter and 4 cm long, with plane end windows 2 mm thick. It gives uniform resolution over the whole field of view. Examples of its application in various types of military equipment are described and some details are given of the Zamboni pile (862 below) developed for use with such equipment. Research and commercial applications are briefly discussed.

538.74 : 621.385.832 **799**

A Magnetic Compass with Cathode-Ray Sensing Element.—W. H. Kliever & R. R. Syrdal. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 529–534.) Full account of an instrument briefly described in 3206 of 1947 (Squier).

539.16.08 **800**

On the Life of Self-Quenching Counters.—S. S. Friedland. (*Phys. Rev.*, 15th Oct. 1948, Vol. 74, No. 8, pp. 898–901.)

539.16.08 **801**

A Study of the Deterioration of Methane-Filled Geiger-Müller Counters.—E. C. Farmer & S. C. Brown. (*Phys. Rev.*, 15th Oct. 1948, Vol. 74, No. 8, pp. 902–905.)

539.16.08 : 621.318.572 **802**

Electronic Counters for Impulses.—Naslin & Peuteman. (*See* 660.)

550.837.7 : 621.3.091 : 553.57 **803**

The Attenuation of Ultra-High Frequency Electromagnetic Radiation by Rocks.—McPetrie & Saxton : Cooper. (*See* 819.)

620.179.16 : 534.321.9.001.8 **804**

Design and Application of Supersonic Flaw Detectors.—D. C. Erdman. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 1271–1276.) A small quartz crystal converts electrical 15-Mc/s radiation into ultrasonic $\frac{1}{3}$-μs pulses. These pulses are reflected from any flaw in a metal forging back to the crystal and re-converted to electrical energy. Block diagrams are given. Oil or glycerine ensures good acoustic coupling with the forging.

621.317.083.7 : 623.746.48 **805**

Telemetering Guided-Missile Performance.—J. C. Coe. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1948, Vol. 36, No. 11, pp. 1404–1414.) The functions required of a telemetering system and the conditions under which it must operate are discussed. Brief details are given of various forms of transducer which convert physical into electrical quantities. Two of the more important types of telemetering systems are described: one involves f.m. of subcarriers; the other is a pulse-position modulation system.

621.365.92 : 621.317.37 **806**

Dielectric Heating — The Measurement of Loss under Rising Temperature.—J. B. Whitehead. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 947–949.)

621.38 **807**

The Manchester Electronics Exhibition.—(*Electronic Engng*, Sept. 1948, Vol. 20, No. 247, pp. 296–297.) Brief descriptions of some of the exhibits.

621.38 : 621.316.718 : 655.324.5 **808**

Radar Technique in an Industrial Control.—W. D. Cockrell. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 269–272.) A system for register control in printing. See also 789 of 1948 (Ludwig).

621.38.001.8 : 669.1 **809**

The Use of Electronic Instruments in Iron and Steel Making.—S. S. Carlisle. (*Engineer, Lond.*, 29th Oct. & 5th Nov. 1948, Vol. 186, Nos. 4840 & 4841, pp. 450–451 & 476–477.) Discussion of electronic techniques for measuring temperatures and small differential pressures, for CO and CO_2 estimation etc. While electronic methods of amplification and detection enable very small quantities to be detected and measured, industrial requirements of ease of maintenance and satisfactory operation under severe conditions of temperature, dust etc. are very stringent. Electronic methods are not necessarily the best available.

621.384 : 621.319.3 **810**

The Palletron, A New Electron Resonator and Its Proposed Application to the Generation of Potentials in the Million-Volt Range.—A. M. Skellett. (*J. appl. Phys.*, Feb. 1948, Vol. 19, No. 2, pp. 187–193.) In an e.s. field of parabolic potential distribution, an electron will have simple harmonic motion. A gap at the centre of the field provides a means of exchange of energy between electrons and the associated circuit. If energy is taken from the electrons the device is an oscillator; if energy is given to them the device may be used to generate a high d.c. voltage. Experimental results on a small model of the h.v. generator are given and a proposed design for the million-volt range is briefly described. Summary noted in 3996 of 1947.

621.384.6 : 621.396.611.4 **811**

A Resonant Cavity Linear Accelerator.—A. B. Cullen, Jr, & J. H. Greig. (*J. appl. Phys.*, Jan. 1948, Vol. 19, No. 1, pp. 47–50.) A folded rectangular waveguide cavity resonant at 2 800 Mc/s is used to accelerate electrons, in three stages, from an injected energy of 2 keV to 300 keV.

621.385.1.001.8 : 531.768.087 **812**

The Measurement of Acceleration with a Vacuum Tube.—W. Ramberg. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 735–740.) For another account see 2528 of 1947.

621.385.833 **813**

Electron Lenses of Hyperbolic Field Structure: Part 1.—R. Rüdenberg. (*J. Franklin Inst.*, Oct. 1948, Vol. 246, No. 4, pp. 311–339.) An electric field of hyperbolic structure focuses uniform parallel rays without aberration. A rigorous mathematical analysis is made possible by the independence of the field equations in the radial and axial directions. Trajectories of the electrons are calculated; the cardinal points are found and compared with those of a glass lens, and Newton's formula is shown to apply to the electron lens.

621.385.833 **814**

The Variation of Beam Angle with Modulation in Electron-Optical Immersion Systems.—L. Jacob. (*Phil. Mag.*, May 1948, Vol. 39, No. 292, pp. 400–408.) A mathematical proof of the dependence of beam angle on modulation, using certain simplifying assumptions. The theory is confirmed by experiment.

623.978 + 550.838] : 538.71 **815**

Air-Borne Magnetometers for Search and Survey.—E. P. Felch, W. J. Means, T. Slonczewski, L. G. Parratt, L. H. Rumbaugh & A. J. Tickner. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 641–651.) See 220 of 1948.

PROPAGATION OF WAVES

538.566 **816**

A General Divergence Formula.—H. J. Riblet & C. B. Barker. (*J. appl. Phys.*, Jan. 1948, Vol. 19, No. 1, pp. 63–70.) A divergence expression is derived for the ratio of energy per steradian reflected from a smooth curved surface to that incident on the surface, when the source and the point of observation are both at finite distances from the reflecting surface. The wavelength is assumed small compared to the radii of curvature of the surface.

538.566 **817**

New Methods in Diffraction Theory.—V. A. Fock. (*Phil. Mag.*, Feb. 1948, Vol. 39, No. 289, pp. 149–155.) Development and discussion of a method for general and practical solution of problems in diffraction of e.m. waves around obstacles of arbitrary shape. The basis of the method is that the transition from light to shadow on the obstacle's surface occurs in a narrow strip along the boundary of the geometrical shadow; the field in this strip is shown to depend only on the value of the field of the incident wave near the point considered and on the geometrical and electrical properties of the diffracting body. See also 2892 of 1947 (Booker & Walkinshaw).

538.566 **818**

Two Theorems relative to the Propagation of Sinusoidal Waves in Stratified Media.—F. Abelès. (*C. R. Acad. Sci., Paris*, 3rd Nov. 1948, Vol. 227, No. 18, pp. 899–900.)

621.3.091 : 550.837.7 : 553.57 **819**

The Attenuation of Ultra-High Frequency Electromagnetic Radiation by Rocks.—J. S. McPetrie & J. A. Saxton : R. I. B. Cooper. (*Proc. phys. Soc.*, 1st Nov. 1948, Vol. 61, No. 347, pp. 482–483.) Comment on 3476 of 1948 (Cooper).

621.396.11 : 551.510.535 **820**

The Estimation and Forecasting of Short-Wave Propagation Conditions, with Special Reference to Naval Communications.—L. E. Beghian. (*J. Instn elect. Engrs*, Part III, Sept. 1948, Vol. 95, No. 37, pp. 351–362; summary, *ibid.*, Part I, Oct. 1948, Vol. 95, No. 94, pp. 459–460.) Description of Admiralty techniques for using ionospheric data in the solution of h.f. communication problems. The computation of ionospheric absorption is discussed and semi-empirical expressions are given for use for distances less than or in excess of 2 500 miles. Methods for determining the lowest usable h.f. are based on these expressions. Ship-to-shore communication and the choice of optimum frequencies are also considered.

621.396.11.029.6 **821**

Radiation and Propagation of Electromagnetic Waves of Short Wavelength.—G. Goudet: J. Voge. (*Ann. Télécommun.*, March–July 1948, Vol. 3, Nos. 3–7, pp. 74–84, 113–125, 155–179, 182–208 & 233–256.) A survey of recent work, both theoretical and experimental, on cm and dm waves, with a bibliography of 137 important papers mentioned in the text. Part 1 discusses e.m. radiation theory and cm-wave equipment. Part 2 discusses reflection, refraction, diffraction, properties of the ionosphere, and the effect of meteorological conditions. Radar receives special attention.

621.396.11.029.6 **822**
The Effect of Ground Constants on the Characteristic Values of the Normal Modes in Non-Standard Propagation of Microwaves.—C. L. Pekeris. (*J. appl. Phys.*, Jan. 1948, Vol. 19, No. 1, pp. 102–105.) An investigation dealing with both vertically and horizontally polarized waves in the wavelength range 1 to 50 000 cm.

621.396.812.3 : 551.510.535 **823**
Fading of Short-Wave Radio Signals and Space-Diversity Reception: Part 1.—S. S. Banerjee & G. C. Mukerjee. (*Phil. Mag.*, Sept. 1948, Vol. 39, No. 296, pp. 697–712.) Observations were made on signals from various s.w. stations, using a superheterodyne receiver with either a mirror galvanometer or an automatic recorder connected in the circuit of the diode second detector. The angle of arrival of downcoming waves was measured by Appleton & Barnett's method. Typical records are given and results are tabulated and correlated with ionospheric layer heights and electronic densities. For space-diversity reception, vertical separation of the aerials is more effective than horizontal.

621.396.11 : 551.510.535 **824**
N.B.S. Circular 462: Ionospheric Radio Propagation. [Book Notice]—National Bureau of Standards. U.S. Government Printing Office, Washington, $1.00. (*Tech. Bull. nat. Bur. Stand.*, Oct. 1948, Vol. 32, No. 10, p. 123.) The physical and mathematical theory underlying e.m. wave propagation, and its relation to practical problems of radio communication, are discussed.

621.396.11 : 551.510.535 **825**
Radio Research Special Report No. 18: Application of Ionospheric Data to Radio Communication. [Book Notice]—Department of Scientific and Industrial Research. H.M. Stationery Office, London, 1948, 1s. (*Govt Publ., Lond.*, Daily List No. 254, 30th Dec. 1948, p. 2.)

RECEPTION

621.396.621 : 621.396.619.13 **826**
On the Concept of Instantaneous Frequency.—J. Laplume. (*C. R. Acad. Sci., Paris*, 11th Oct. 1948, Vol. 227, No. 15, pp. 722–724.) Discussion with particular reference to f.m. discriminators.

621.396.621 (083.74) + 621.396.615.12] : 621.317.79 **827**
Standard Receiver and Generator for Ultra-High Frequencies.—Cabessa & Phélizon. (*See* 792.)

STATIONS AND COMMUNICATION SYSTEMS

621.39 **828**
Telecommunications for the 1948 Olympic Games.—E. R. Smith & C. W. Sallnow. (*P. O. elect. Engrs' J.*, Oct. 1948, Vol. 41, Part 3, pp. 157–162.) An exchange with a multiple capacity of 2 800 was installed by the British Post Office. Lines were provided for administration, B.B.C. programmes, field events, teleprinter networks and telephone services for public and press. See also 522 of February (Hotine).

621.395.44 : 621.315.052.63 **829**
A Carrier Telephone System for Rural Service.—J. M. Barstow. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 501–507.) For another account see 2612 of 1948.

621.395.44 : 621.315.052.63 **830**
Application of Rural Carrier Telephone System.—E. H. B. Bartelink, L. E. Cook, F. A. Cowan & G. R. Messmer. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 511–517. Discussion, pp. 517–518.) Discussion of modifications required in the power circuits to permit carrier-frequency transmission. See also 829 above and back references.

621.396 **831**
Technical Problems of Military Radio Communications of the Future.—J. Hessel. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1948, Vol. 36, No. 11, pp. 1402–1403.) A communication system of adequate mobility, traffic capacity and reliability is required. The factors prohibiting the present realization of such a system are discussed, and basic research problems outlined.

621.396.1 **832**
Copenhagen Frequency Allocations.—(*Wireless World*, Nov. 1948, Vol. 54, No. 11, pp. 397–399.) New wavelengths for European broadcasting stations are listed. In some cases directional aerials protecting particular regions must be used. Particulars are given of 8 additional B.B.C. transmitter locations and of the way in which the B.B.C. proposes to use the 14 wavelengths now allotted to Great Britain.

621.396.3 : 621.394.441 **833**
A Multi-Channel Radio Telegraph Equipment.—G. N. Davison & R. J. Pickard. (*P.O. elect. Engrs' J.*, Oct. 1948, Vol. 41, Part 3, pp. 148–153.) The advantages of 2-tone and diversity operation are discussed briefly. A description is given of 2-tone voice-frequency equipment developed by the British Post Office for use by the Services in single-sideband h.f. radio circuits using triple space-diversity reception. Satisfactory operation is obtained with signals varying from +5 to −45 db relative to 1 mW. The small time-constant of the a.g.c. circuit enables the receiver to follow deep and rapid fading.

621.396.44 : 621.315.052.63 **834**
A New Single-Side-Band Carrier System for Power Lines.—B. E. Lenehan. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 826–830. Discussion, p. 830.) See 4027 of 1947.

621.396.619 **835**
Frequency Analysis of Modulated Pulses.—S. H. Moss. (*Phil. Mag.*, Sept. 1948, Vol. 39, No. 296, pp. 663–691.) A mathematical analysis of the frequency spectra of modulated recurrent pulses of different types. The relationship between the form of the modulated carrier and the applied modulation waveform is studied, with particular reference to single- and double-tone waveforms. Five types of modulation are investigated: phase, frequency and amplitude modulation of indefinitely narrow unit pulses, and symmetric and asymmetric width modulation of ideal rectangular pulses of unit amplitude. The results are summarized in tables.

621.396.619 **836**
Modulation in Communication.—F. A. Cowan. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 792–796.)

621.396.619 **837**
Composite Amplitude and Phase Modulation.—O. G. Villard, Jr. (*Electronics*, Nov. 1948, Vol. 21, No. 11, pp. 86–89.) In this system a carrier is modulated in both phase and amplitude. The phases of the a.f. inputs to the two modulators differ by 90°. By adjusting the depth of modulation the lower sidebands can be cancelled, leaving a single-sideband transmission with

first-order sideband level corresponding to 100% a.m., but with appreciable second-order sidebands. A normal a.m. receiver can be used.

621.396.619.13 : 621.396.65 **838**

The Application of Heterodyne Modulation to Wide-Band Frequency-Modulated Television Relays.—W. P. Boothroyd. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 1126–1130.) Heterodyne modulation consists in applying f.m. to a fixed carrier frequency and selecting the upper sideband. In a particular equipment considered, a f.m. band of 107–124 Mc/s was used with a carrier frequency of approximately 1 235 Mc/s furnished by a klystron. Apparatus design is discussed.

621.396.619.13 : 621.396.97 : 621.396.621 **839**

F.M. Broadcast Network with Radio Links.—D. K. de Neuf. (*Communications*, Oct. 1948, Vol. 28, No. 10, pp. 12–15.) For another series of accounts see 494 of February (Sleeper) and cross references.

621.396.619.15 **840**

Frequency Shift Telegraphy — Radio and Wire Applications.—J. R. Davey & A. L. Matte. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 479–493. Discussion, pp. 493–494.) See 2362 of 1948.

621.396.619.15 : 621.394.441 **841**

Frequency-Shift Keying.—T. Roddam. (*Wireless World*, Nov. 1948, Vol. 54, No. 11, pp. 400–402.) Comparison with on-off keying methods.

621.396.619.16 **842**

Pulse Code Modulation.—H. S. Black & J. O. Edson. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 895–899.) Full paper. Summary noted in 2363 of 1948.

621.396.619.16 **843**

The Philosophy of P.C.M.—B. M. Oliver, J. R. Pierce & C. E. Shannon. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1948, Vol. 36, No. 11, pp. 1324–1331.) Some of the advantages of pulse-code modulation are discussed and the possible achievements of the system are compared with those of a f.m. system. In general, pulse-code modulation seems ideally suited for multiplex message circuits where good quality and high reliability are required.

621.396.619.16 **844**

Decoding in P.C.M.—R. L. Carbrey. (*Bell Lab. Rec.*, Nov. 1948, Vol. 26, No. 11, pp. 451–456.)

621.396.619.16 : 621.395.43 **845**

Multiplex Telephony Systems with Impulse Modulation.—S. van Mierlo. (*Tijdschr. ned. Radiogenoot.*, Sept. 1948, Vol. 13, No. 5, pp. 135–170. Discussion, p. 171. In Dutch, with English summary.) Discussion of: (*a*) the relative merits of pulse-amplitude, pulse-position and pulse-code modulation systems, in which the pulses may be used for a.m. or f.m. of a carrier wave, (*b*) bandwidth and signal/noise ratios, (*c*) distributors, modulators and demodulators, (*d*) two experimental pulse-position modulation systems, (*e*) two commercial equipments now available.

621.396.619.16 : 621.396.813 **846**

Distortion and Band-Width Characteristics of Pulse Modulation.—H. L. Krauss & P. F. Ordung. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 984–988.) The minimum allowable ratio of pulse repetition frequency to maximum a.f. is expressed in terms of the distortion and the percentage modulation. The effects of pulse width, pulse shape, and percentage modulation on the required bandwidth are also discussed.

621.396.619.16 : 621.396.813 : 621.317.35 **847**

Distortion in a Pulse Count Modulation System.—Clavier, Panter & Grieg. (*See* 768.)

621.396.65 **848**

Indirect Microwave Relay System.—In 219 of January please read R. P. Wakeman for R. R. Wakeman.

621.396.65 : 621.396.615.142.2 **849**

ST [studio/transmitter] **Equipment using Klystrons.**—In 220 of January insert M. Silver & H. French as authors.

621.396.65 : [621.397.5 + 621.395.43 **850**

Use of Radio Links for the Transmission of Television and Multiplex Telephony Signals.—J. Laplume. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 396–397.) Summary only. Recent investigations have shown that for these purposes radio links have many definite advantages and are much cheaper than cable links.

621.396.65.029.64 : 621.397.743 **851**

A New Microwave Television System.—J. F. Wentz & K. D. Smith. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 465–470.) Describes a point-to-point relay system using f.m. with centre frequency between 3 900 and 4 400 Mc/s, and 4–5-Mc/s video signal. Filters for 2-channel operation on one aerial (paraboloid or lens) are provided. Block diagrams and some test and performance figures are given. See also 1755 of 1948 (Durkee) and 1756 of 1948 (J.M.).

621.396.7 **852**

Criggion Radio Station.—A. Cook & L. L. Hall. (*P.O. elect. Engrs' J.*, Oct. 1948, Vol. 41, No. 2, pp. 123–129.) For another account see 2371 of 1948 (West, Cook, Hall & Sturgess).

SUBSIDIARY APPARATUS

621-526 **853**

Dimensionless Analysis of Servomechanisms by Electrical Analogy: Part 1.—G. D. McCann & S. W. Herwald. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 111–118.)

621-526 **854**

A Comparison of Two Basic Servomechanism Types.—H. Harris. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 83–92. Discussion, pp. 92–93.)

621-526 **855**

The Analysis and an Optimum Synthesis of Linear Servomechanisms.—D. Herr & I. Gerst. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 959–970.)

621-526 **856**

Stabilizing Servomechanisms.—D. McDonald. (*Electronics*, Nov. 1948, Vol. 21, No. 11, pp. 112–116.) A circuit having a transfer function which is the inverse of the transfer function of the servomechanism can be used as a stabilization network. Such a circuit can be approximately realized by means of a feedback amplifier having in its feedback path a network whose transfer function is proportional to that of the servomechanism.

621-526 **857**

Stabilization of Carrier-Frequency Servomechanisms: Parts 1-3.—A. Sobczyk. (*J. Franklin Inst.*, July–Sept. 1948, Vol. 246, Nos. 1–3, pp. 21–43, 95–121 & 187–213.)

621-526 : 061.3 **858**

Some Particularly Interesting Points brought out at the Congress on Servomechanisms, London, May 1947.—M. Naslin. (*Onde élect.*, Nov. 1948, Vol. 28, No. 260, pp. 445–454.) Discussion of selected papers whose titles were noted in 4039 of 1947.

621.316.722 **859**

Solution of the General Voltage Regulator Problem by Electrical Analogy.—E. L. Harder. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 815–825. Discussion, p. 825.)

621.316.722.1 **860**

Regulator for 400-c/s Inverter.—C. A. Helber. (*Electronics*, Nov. 1948, Vol. 21, No. 11, pp. 90–91.) Describes stabilizing equipment for a 250-VA aircraft rotary converter. A voltage-regulator valve controls, through a thyratron and a saturable reactor, the a.c. input to the rectifier supplying the field excitation for the converter.

621.316.74 **861**

Some Aspects of Moderate Precision Temperature Control in Communication Engineering.—M. P. Johnson. (*J. Brit. Instn Radio Engrs*, Sept./Oct. 1948, Vol. 8, No. 5, pp. 250–259.) Discussion with special reference to the design of master-oscillator ovens. Thermostats of the bimetallic and Hg type are considered and three electronic thermostats are treated in more detail, with applications to practical oven design. Experimental results show the influence of heat insulation in reducing the effects of ambient-temperature variations and also on thermostat ripple.

621.352.32 **862**

The Dry Voltaic Pile.—A. Elliott. (*Electronic Engng*, Oct. 1948, Vol. 20, No. 248, pp. 317–319.) A small, light and reliable source of high voltage with particular application to infra-red telescopes. Development of the pile from the laboratory experimental stage to mass production is discussed.

621.396.68 : 621.316.722 **863**

Stabilized Power Supplies : Part 2 — Some Refinements and Modifications.—M. G. Scroggie. (*Wireless World*, Nov. 1948, Vol. 54, No. 11, pp. 415–418.) Continuation of 231 of January.

621.396.69 **864**

Highlights of the "Super-Power" 8-Section Pylon.—O. O. Fiet. (*Broadcast News*, Aug. 1948, No. 50, pp. 36–51.) Effective f.m. power up to 1 200 kW can be radiated.

TELEVISION AND PHOTOTELEGRAPHY

061.3 : 621.397.5 **865**

Television Conference, Paris, 25th–30th October 1948.—(*Onde élect.*, Oct. & Dec. 1948, Vol. 28, Nos. 258/259 & 261, pp. 350–420 & 457–468.) Summaries of papers read at the Conference. For selected individual abstracts see this and other sections.

061.3 : 621.397.5 **866**

The Television Congress, Paris, 25th–30th October, 1948.—Y. Angel. (*Onde élect.*, Dec. 1948, Vol. 28, No. 261, pp. 457–460.) A short account of the general organization.

061.3 : 621.397.5 **867**

The International Television Convention at Zurich.—(*Electronic Engng*, Nov. 1948, Vol. 20, No. 249, pp. 362–363.) The lectures included "Television and Outside Broadcast Practice in Great Britain", by T. H. Bridgewater, and an account by H. Thiemann of the development of the Swiss A.F.I.F. (Abteilung für industrielle Forschung) large-screen system based on the variations in the angle of refraction of light directed on to the surface of a thin oil film (see 296 of 1948). A demonstration of this method using the French ériscope camera gave pictures of cinema standard. The need for international standards was discussed.

621.397.2 : 551.509.2 **868**

Television Broadcasting of Meteorological Information.—R. Clausse. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 358–360.) Summary only. Discusses the principles of and practical equipment for the rapid automatic transmission of meteorological charts.

621.397.3 : 778.534.4 **869**

Color-Television Film Scanner.—B. Erde. (*J. Soc. Mot. Pict. Engrs*, Oct. 1948, Vol. 51, No. 4, pp. 351–372.) The film moves at a constant speed across a gate which is double the height of the picture frame. A fixed optical system of 6 lenses and filters and a rotating shutter project the successive primary-colour pictures on to a non-storage type of pickup tube. Compensated electronic scanning equipment allows for the continuous motion of the film.

621.397.331.2 **870**

'Knight' Scanning.—P. M. G. Toulon. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 412–416.) Summary only. Various methods of scanning are discussed and a method is described in which the order of scanning the elementary squares into which the picture is divided corresponds to a series of moves of a chess knight. The advantages of this method are enumerated. Definition for a 450-line system is comparable with that of a 1 000-line system using ordinary interlaced scanning.

621.397.5 **871**

A New Process for Television in Colour.—Y. Angel. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 353–354.) Summary only. The method proposed uses only a single analysis: that of a triple image formed by the juxtaposition of 3 primary monochromatic images produced by optical methods of decomposition of the coloured image to be transmitted. In reception, the 3 primary images are observed through filters and an optical system which assures their proper superposition. Equipment suitable for such a system is discussed.

621.397.5 **872**

After the Television Congress.—M. Chauvierre. (*Radio franç.*, Dec. 1948, No. 12, pp. 1–4.) Comparison of television developments in America, Britain and France shows that France at present is considerably behind, although the French super-ériscope will give images of a quality not surpassed by any other pickup.

The author considers the adoption of an 819-line standard (880 below) to be a mistake and that, as in Britain, the present standard should be retained for a specified period and then reviewed. Such a policy would allow manufacturers to concentrate on the quick production of large numbers of receivers of present designs.

621.397.5 **873**

Experimental Equipment for 729-Line Television.—J. L. Delvaux. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 370–372.) Summary only. Reasons for the choice of 729 lines are given, with some particulars of equipment developed by the C.F.T.H.

621.397.5 **874**

Television and its Industrial Outlook To-day.—P. Grivet. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 381–383.) Summary only.

621.397.5 : 535.88 : 532.62 **875**

Large-Screen Television and the Eidophor Process.—H. Thiemann. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 409–411.) Summary only. For a full account of this process see 296 of 1948 and back references. See also 867 above.

621.397.5 : 778.5 **876**

Numerical Values of the Definition of Cinematograph Films — Comparison with Television.—J. L. Delvaux. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 369–370.) Summary only.

621.397.5 : 778.53 **877**

Methods of Cinematographic Recording using Television.—Y. L. Delbord. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 366–368.) Summary only. Methods with intermittent and with continuous motion of the film are discussed and an arrangement suitable for recording in colour is outlined.

621.397.5 : 791.45 **878**

The Relations between Television and the Cinema.—S. Mallein. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 350–352.) Summary only.

621.397.5 (083.74) + 621.397.331.2 **879**

Proposals for the Standardization of Television in Italy, and New Electronic Generator for Television Synchronization.—A. V. Castellani. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 357–358.) Summary only. A system is proposed with transmission for about 1 200 lines interlaced, and reception either on 1 200 lines interlaced for large-screen receivers, with the quality of 35-mm film, or on 600 lines non-interlaced for home direct-viewing receivers.

A network of transmitting stations, mainly alpine and telecontrolled, would be connected with the producing centres by radio links, a single central station controlling the synchronization signals. A generator has been produced in which interlacing, stable and independent of supply voltage variations, can be obtained with an even number of lines, while control is easy and operation certain.

621.397.5 (083.74) **880**

France has decided on her New Television Standard.—Y.A. (*Onde élect.*, Dec. 1948, Vol. 28, No. 261, p. 460.) Summary only. The number of lines is to be 819, a compromise between very-high definition (about 1 000 lines) and medium definition (400–600 lines). The frequency band is to be 174–216 Mc/s and channel bandwidth 14 Mc/s. See also 872 above.

621.397.5(42) **881**

British Television.—(*Electronic Engng*, Sept. 1948, Vol. 20, No. 247, Supplement.) A historical introduction and a brief illustrated discussion of the B.B.C. service. See also 891 below.

621.397.5.09 **882**

Measurement of Phase Constants and Group Propagation Times in Television.—A. P. A. Fromageot. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 379–380.) Summary only. A quadripole ensures perfect transmission only when its attenuation is independent of the frequency and its phase constant is proportional to the frequency. The latter condition implies that group propagation time should be constant. Methods of measurement for the two quantities concerned are discussed.

621.397.6 : 621.316.345 **883**

TV Control Console Design.—J. Ruston. (*Communications*, Oct. 1948, Vol. 28, No. 10, pp. 8–11 . . 33.) Discussion of master control requirements, video signal monitoring, bridging and terminating connections, modulation measurements, circuits, and mechanical layout.

621.397.61 : 621.396.619 **884**

Modulation of Television Transmitters and Cathode Excitation.—H. H. Ernyei. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 373–375.) Summary only. Grid modulation and cathode excitation are discussed with the help of equivalent circuits, which are again used in considering neutrodynes. A new equivalent scheme is given.

621.397.62 **885**

Postwar Television Receiver Design.—D. W. Pugsley. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 453–458.) Illustrated discussion of recent improvements for both direct-view and projection receivers.

621.397.62 : 535.88 **886**

Large-Screen Projection of Television Images.—A. Cazalas. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 361–363.) Summary only. The characteristics of three R.C.A. projection systems and of that of the Compagnie des Compteurs are tabulated and discussed. See also 1797 of 1948 and 238 of January (Maloff).

621.397.645 **887**

Pentriode Amplifiers.—Zeidler & Noe. (*See* 682.)

621.397.645 : 621.385.4 **888**

Duplex Tetrode U.H.F. Power Tubes.—Smith & Hegbar. (*See* 906.)

621.397.7 **889**

Television Equipment for Broadcast Stations.—W. L. Lawrence. (*Trans. Amer. Inst. elect. Engrs*, 1947, Vol. 66, pp. 443–452.) Description, with photographs and block diagrams, of a complete studio and transmitting equipment.

621.397.7 **890**

Some Problems arising from the Working of a Television Centre.—H. Delaby. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 364–365.) Summary only. Discussion of various technical and production problems. Financial questions are not considered.

621.397.7 (42) **891**

Television Development in Britain.—(*Nature, Lond.*, 18th Sept. 1948, Vol. 162, No. 4116, pp. 427–428.) The Television Advisory Committee (appointed on the recommendation of the Hankey Television Committee, summaries of whose report were noted in 3002, 3584 and 3585 of 1945) considers that possible improvements in quality are too slight to justify any change of the existing 405-line standard for several years. The London television station will therefore continue to operate on this standard. The Midlands station at Sutton Coldfield will do likewise ; it should be in operation at the end of 1949, with a carrier frequency of about 60 Mc/s, aerial system on a mast 750 ft high, and a reception range of approximately 50 miles. Higher power than at Alexandra Palace will be used for both sound and vision carriers. Radio and cable links between London and Sutton Coldfield are being provided. A further station in the north of England is contemplated.

621.397.743 : 621.396.65.029.64 **892**

A New Microwave Television System.—Wentz & Smith. (*See* 851.)

TRANSMISSION

621.396.61 **893**

A High-Level Single-Sideband Transmitter.—O. G. Villard, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1948, Vol. 36, No. 11, pp. 1419–1425.) Two high-power balanced modulators, biased to cut-off in the absence of an audio input and using tubes which behave substantially as constant-current sources, may be connected to a common tank circuit for the generation of single-sideband signals by the phase-rotation method. The efficiency obtainable with this arrangement approximates to that of a conventional linear amplifier. Simplicity, ease of adjustment, and power economy make this circuit suitable for applications where a certain amount of distortion and undesired sideband output can be tolerated.

621.396.619 : 621.396.615.141.2 **894**

Wide-Band Modulation with Magnetron.—H. Gutton & J. Ortusi. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 384–387.) Summary only. A new method of modulation, suitable for dm and cm waves, is based on the introduction, into the output waveguide, of an impedance which can be varied from 0 to ∞ by using the impedance variations of a whole-anode or a cavity magnetron. In the latter case, with negative reaction between the successive cavities, a modulation bandwidth 10% of the carrier frequency has been achieved. The method can be used for carrier powers of several kilowatts, though the video amplifier power need not exceed 1 W.

621.396.8 **895**

Spectra of Quantized Signals.—W. R. Bennett. (*Bell Syst. tech. J.*, July 1948, Vol. 27, No. 3, pp. 446–472.) To determine the number of quantized steps required to transmit a specific type of signal, the relation between distortion and step size must be found. Quantizing of magnitude only is discussed mathematically in terms of a 'perfect step transducer'. Combined quantizing of magnitude and time is discussed in terms of a theory of periodic sampling of signals. Results are shown graphically. Some experimental results obtained with a laboratory model of a quantizer are included.

VALVES AND THERMIONICS

621.383 **896**

Concerning the Use of a 920 Double Photo-Cell in a Current Amplifier and Stabilizer.—B. M. Banerjee & S. K. Sen. (*Indian J. Phys.*, Jan. 1948, Vol. 22, No. 1, pp. 43–50.) In a current-stabilizer circuit a gas-filled double photocell requires careful adjustment and is less sensitive than two separate photocells or a vacuum double photocell.

621.383 : 621.396.822 **897**

Noise in Vacuum Phototubes at High Current Levels.—R. F. Morrison. (*Electronics*, Nov. 1948, Vol. 21, No. 11, pp. 126..168.) Measurements of output noise indicate that, for cathode currents from 50 μA to 1 mA, shot effect is the only important source of noise.

621.383 : 621.397.5 **898**

Electron-Multiplier Cell — Its Use in Television.—A. Lallemand. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 394–395.) Summary only. Multiplier cells are normally produced with 7 stages, rarely with 12, though production difficulties for 12 stages are little greater than for 7. Investigations have shown that with a 12-stage cell having an Sb-Cs photocathode, for a source at 2 400°K, a photocurrent is obtained equal to the dark current for a flux of 10^{-9} lumen. Such a cell is particularly suited for responding to the long waves from a c.r. tube. Its dark current is so small that cooling is quite unnecessary.

621.383.4 **899**

Lead Selenide Photo-Conductive Cells.—J. Starkiewicz. (*J. opt. Soc. Amer.*, May 1948, Vol. 38, No. 5, p. 481.) Thin layers of PbSe can be activated in vacuo so that they have marked photoconductive sensitivity at room temperature. The process is analogous to that for PbS noted in 3709 of 1947 (Sosnowski, Starkiewicz & Simpson) and 443 of 1948 (Sosnowski), but is complicated by the fact that Se, formed during activation, tends to remain in the layer.

621.383.5 **900**

The Efficiency of the Barrier Layer Photo-Cell.—R. A. Houstoun. (*Phil. Mag.*, Nov. 1948, Vol. 39, No. 298, pp. 902–910.) The highest efficiency obtained for approximately monochromatic light for 5 commercial photocells was 6.4×10^{-8}, and for white light 6.2×10^{-5}, in contrast to manufacturers' claims of 50%.

621.385 **901**

Radio Valve Practice.—(*Electronic Engng*, Oct. 1948, Vol. 20, No. 248, pp. 321–324.) Long summary of British Radio Valve Manufacturers' Association recommendations for obtaining optimum performance. The importance of consulting the manufacturer before including valves in unusual circuits is emphasized.

621.385 : 513.761.5 **902**

On the Similitude of Valves.—A. Martinot-Lagarde. (*Onde élect.*, Nov. 1948, Vol. 28, No. 260, pp. 440–444.) A general method of treatment is presented which is essentially based on Vaschy's demonstration of the central theorem of dimensional analysis. The method is applied to discussion of output, amplification, anode current, cathode emission etc., as functions of frequency, valve dimensions and applied voltages.

621.385 : 621.397.61 **903**

Theoretical Methods of Study and Recent Realizations of Transmitting Valves for Television.—G. Lehmann. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 398–401.) Summary only. The special features of some triodes, tetrodes and pentodes for powers up to 200 kW and frequencies to 2 000 Mc/s are briefly considered. Design methods based on dimensional analysis (3821 of 1946) can take account of transit-time and space-charge effects. Fundamental relations for triodes are tabulated. For valves operating continuously, or nearly so, at frequencies below 600 Mc/s, the principal limiting factor is the anode dissipation, while above 600 Mc/s it is the cathode emission. Suitable design formulae for these two cases are given.

621.385.029.64 : 621.397.6 **904**

On the Help which some Recent Ideas concerning U.H.F. Valves can give in Television.—R. Warnecke & P. Guénard. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 417–420.) Summary only. Discussion, with special reference to television, of (*a*) high-power triodes and tetrodes, (*b*) v.m. valves, (*c*) magnetrons, (*d*) klystrons, (*e*) distributed amplification.

621.385.1 : 621.397.61 **905**

Some Recent Transmitting Valves for Television.—J. Becquemont. (*Onde élect.*, Oct. 1948, Vol. 28, Nos. 258/259, pp. 355–357.) Summary only. Discussion of modern constructional developments, with particulars of valves with output of 500 W at 600 Mc/s.

621.385.4 : 621.397.645 **906**

Duplex Tetrode U.H.F. Power Tubes.—P. T. Smith & H. R. Hegbar. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1948, Vol. 36, No. 11, pp. 1348–1353.) The design and development of wide-band power valves are considered, with particular reference to television applications. Methods of obtaining the required performance are discussed qualitatively. A 5-kW 300-Mc/s liquid-cooled internally neutralized double tetrode is described.

621.385.832 : 621.318.572 **907**

Electrostatically Focused Radial-Beam Tube.—A. M. Skellett. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1948, Vol. 36, No. 11, pp. 1354–1357.) Discussion of the principle of operation and the construction of a tube in which the electron beam is focused and rotated by means of internal e.s. fields. The tube has a single cathode with twelve control-grid and anode elements fixed in a circle around it. It thus forms an electronic distributor with many applications as a high-speed switch. See also 3167 of 1944.

621.396.615.141.2 **908**

High-Power Interdigital Magnetrons.—J. F. Hull & A. W. Randals. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1948, Vol. 36, No. 11, pp. 1357–1363.) The operation of a pillbox cavity interdigital magnetron in the cavity mode is described. Stability of operation has been achieved by the addition of cathode decoupling chokes. Continuous outputs up to 500 W with an efficiency of 70% have been obtained for λ ≃ 10 cm.

621.396.615.141.2 **909**

The Rising-Sun Magnetron.—S. Millman & A. T. Nordsieck. (*J. appl. Phys.*, Feb. 1948, Vol. 19, No. 2, pp. 156–165.) Full paper: summary noted in 296 of 1947. See also 293 of 1947 (Fisk, Hagstrum & Hartman).

621.396.615.141.2 **910**

The Resonant Modes of the Rising-Sun and Other Unstrapped Magnetron Anode Blocks.—N. M. Kroll & W. E. Lamb, Jr. (*J. appl. Phys.*, Feb. 1948, Vol. 19, No. 2, pp. 166–186.) Full paper: summary noted in 297 of 1947.

621.396.615.142 **911**

Transit-Time Effects in Output Fields.—T. S. Popham. (*Wireless Engr*, Nov. 1948, Vol. 25, No. 302, pp. 353–360.) An analysis of the mechanism whereby energy is transferred from a modulated electron beam to an electric field by means of a pair of electrodes. The oscillatory-field energy produced at large transit angles remains comparable with that produced at small angles. The effect of secondary electron radiation from one electrode is discussed and a critical value of transit angle is derived above which there is a considerable increase in the suppression of secondary radiation.

621.396.645 : 537.311.33 : 621.315.59 **912**

Characteristics of Amplifying Crystals.—S. Y. White. (*Audio Engng, N.Y.*, Nov. 1948, Vol. 32, No. 11, pp. 18–19.) Discussion of design and performance characteristics of oscillators incorporating the transistor. See also 913–916 below and back references.

621.396.645 : 537.311.33 : 621.315.59 **913**

Clarification of Germanium Triode Characteristics.—S. Y. White. (*Audio Engng, N.Y.*, Dec. 1948, Vol. 32, No. 12, pp. 19–21..44.) A review of present information. It is not yet possible to produce Ge triodes in quantity at a competitive price, and they are unlikely yet to displace ordinary valves. Potential advantages and present limitations are considered. See also 265 of January, 581 and 582 of February, and 912 above.

621.396.645 : 537.311.33 : 621.315.59 **914**

The Transistor, or the Return of the Crystal.—L. Chrétien. (*T.S.F. pour Tous*, Oct. 1948, Vol. 24, No. 240, pp. 260–262.) An account based on that given in *Electronics*, Sept. 1948, Vol. 21, No. 9, pp. 68–71 (D.G.F. & F.H.R.). See also 913 above and back references.

621.396.645 : 537.311.33 : 621.315.59 **915**

Transistor: the Crystal Amplifier and Oscillator.—J. P. Arnaud. (*Rev. telegr., Buenos Aires*, Oct. 1948, Vol. 37, No. 433, pp. 715–720.) A general description, with theory, given in a lecture to the Buenos Aires section of the I.R.E. References are given to all pertinent publications to date. See also 913 above and back references.

621.396.828.1 **916**

Reducing Hum in Pentodes.—I. Zakarias. (*Electronics*, Nov. 1948, Vol. 21, No. 11, pp. 170..178.) The operating condition of a pentode affects the relative hum current appearing in the anode circuit; this hum current can sometimes be made to vary about zero magnitude. Experimental curves showing relative hum current for various pentodes and operating conditions are included.

621.396.615.141.2 : 621.396.619.23 **917**

Pulse Generators. [Book Review]—G. N. Glasoe & J. V. Lebacqz. McGraw-Hill, New York & London, 1948, 722 pp., $9. (*Proc. Inst. Radio Engrs, W. & E.*, Nov. 1948, Vol. 36, No. 11, p. 1396.) Volume 5 of the Radiation Laboratory series. The book might have been entitled 'Magnetron Modulators'. The various types of pulse generator used with magnetrons, and their associated components, are discussed in detail. For another review see *Nature, Lond.*, 13th Nov. 1948, Vol. 162, No. 4124, p. 754.

MISCELLANEOUS

05 : 550.38 **918**

Geomagnetic and Geoelectric Literature in Two New German Periodicals.—H. G. Macht. (*Terr. Magn. atmos. Elect.*, June 1948, Vol. 53, No. 2, pp. 169–171.) *Zeitschrift für Meteorologie* is a new German journal which has replaced *Met. Z.* *Deutsche Hydrographische Zeitschrift* has also replaced *Annalen der Hydrographie und Maritimen Meteorologie*. Brief details of editorial organization of these two journals are given, with abstracts of selected articles. See also 705, 712 and 714 above.

061.3 : 01 **919**

The Royal Society Scientific Information Conference, 21 June–2 July 1948: Report and Papers Submitted. [Book Notice]—The Royal Society, London, 723 pp., 25s. Full report of the Conference noted in 590 of February.

061.3 : [621.395.06 + 620.193 **920**

C. C. I. (F.) Meeting, Stockholm, June 1948.—(*P.O. elect. Engrs' J.*, Oct. 1948, Vol. 41, Part 3, p. 154.) A brief review of the discussions on the European switching plan and on cable corrosion.

061.3 : 621.396 **921**

Fifth Plenary Meeting of the C.C.I.R., Stockholm, July, 1948.—(*P.O. elect. Engrs' J.*, Oct. 1948, Vol. 41, Part 3, pp. 155–156.) Titles of 13 international study groups are listed. Recommendations are very briefly discussed.

621.3 **922**

Fundamentals of Electrical Engineering. [Book Review]—V. P. Hessler & J. J. Carey. McGraw-Hill, London, 241 pp., 45s. (*Wireless Engr*, Nov. 1948, Vol. 25, No. 302, pp. 370–371.) A background of electricity and magnetism from a physics course is assumed. The book deals solely with fundamentals, and there is no mention of electrical machines or thermionic valves. Alternating current is not considered.

621.396.029.6 **923**

Radio at Ultra-High Frequencies: Vol. 2. [Book Notice]—A. N. Goldsmith, A. F. Van Dyck, R. S. Burnap, E. T. Dickey & G. M. K. Baker (Eds). Radio Corporation of America, Princeton, N.J., 1948, 485 pp., $2.50 in U.S., $2.70 elsewhere. Covers the period 1940–1947. Summaries of the papers contained in Vol. 1 (1930–1939) are also included. Many of the papers have already appeared in *RCA Rev.* and other publications; here they are arranged under broad subject headings.

ABSTRACTS and REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

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ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 **924**

References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, Jan. 1949, Vol. 21, No. 1, pp. 43–48.) Continuation of 602 of March.

534.2 **925**

On the Acoustic Boundary Layer in front of Rigid Walls.—L. Cremer. (*Arch. elekt. Übertragung*, April/May 1948, Vol. 2, Nos. 4/5, pp. 136–139.)

534.213.4 **926**

Propagation of an Amplitude-Modulated Sound Wave in a Tube.—G. G. Sacerdote. (*Arch. elekt. Übertragung*, April/May 1948, Vol. 2, Nos. 4/5, pp. 186–189.) A formula is derived for the radiation pressure of a plane wave. If the tube is in resonance at the modulation frequency, a simple phase-measurement method can be developed for determining the absorption coefficient of a material at different frequencies.

534.22 **927**

Velocity of Sound in Free Air.—J. M. A. Lenihan. (*Nature, Lond.*, 23rd Oct. 1948, Vol. 162, No. 4121, pp. 656–657.) Discussion of 940 determinations by the oscillographic method described in 848 of 1944. The mean value for the velocity of 13.5-kc/s sound in dry air at temperature 273.16°K and pressure 1 013.2 mb, and containing 0.03% CO_2, was found to be 331.45 ±0.04 m/s.

534.222.1 : 621.392.26† : 538.566 **928**

On the Theory of Spherically Symmetric Inhomogeneous Wave Guides, in Connection with Tropospheric Radio Propagation and Under-Water Acoustic Propagation.—Bremmer. (*See* 1158.)

534.232 : 534.321.9 : 546.391.85 **929**

On the Suitability of Ammonium Phosphate Crystals as Ultrasonic Generators.—H. Bömmel. (*Helv. phys. Acta*, 30th Sept. 1948, Vol. 21, No. 5, pp. 403–410 In German.) A rectangular plate, $15.3 \times 15.1 \times 1.71$ mm, was cut with its plane at equal angles to the three crystal axes so as to obtain maximum amplitude for thickness vibrations. Resonance frequencies, ranging from 966 to 7 120 kc/s, and relative ultrasonic intensities, are tabulated. The intensity is proportional to the square of the applied h.f. voltage. The resonance curve for 966 kc/s has a secondary maximum at 983 kc/s with intensity 90% of that for 966 kc/s, but the resonance curve for 3 245 kc/s is of normal type, with a half-intensity width of 60 kc/s. Schlieren photographs show the oscillations to be very complex. The measured ultrasonic output at 966 kc/s, with an applied h.f. voltage of 155 V, was about 0.1 W, increasing to about 2.5 W with 770 V, at which voltage the crystal fractured.

534.24 : 534.321.9 **930**

The Ultrasonic Interferometer with Resonant Liquid Column.—F. E. Fox & J. L. Hunter. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1948, Vol. 36, No. 12, pp. 1500–1503.) Mathematical analysis of a method of measuring the coefficients of absorption and reflection of ultrasonic waves set up in a fluid column by a crystal oscillator, by determining current variation in the associated electrical circuit when all parts of the system (electrical, mechanical and acoustical) are adjusted to resonance.

534.321.9 : 534.373 **931**

Absorption of Ultrasonic Waves by Solids.—R. Mercier & N. Banderet. (*Helv. phys. Acta*, 10th Aug. 1948, Vol. 21, Nos. 3/4, p. 220. In French.) Summary of Swiss Phys. Soc. paper.

534.321.9 : 534.373 **932**

Ultrasonic Reverberation Measurements in Liquids.—C. E. Mulders. (*Appl. sci. Res.*, 1948, Vol. B1, No. 3, pp. 149–167.) The absorption of waves of frequency 0.735–1.475 Mc/s in water is obtained by measuring the reverberation time in cylindrical vessels containing 2–3 litres of water. Absorptions as small as 0.1 db/m can be measured within 10–30%, according to the frequency used.

534.422 : 534.7 **933**

Biological Effects of Intense Sound.—D. H. Eldredge & H. O. Parrack. (*J. acoust. Soc. Amer.*, Jan. 1949, Vol. 21, No. 1, p. 55.) Summary of Acoustical Society of America paper. Discussion of the physiological reaction of man and animals exposed to the sound fields generated by (*a*) jet engines in test cells, (*b*) a powerful laboratory siren. Temporary hearing losses up to 70 db, heating of human skin, and strong vibratory sensations in various parts of the body were observed. For rats and guinea pigs a difference of about 3 db in intensity means the difference between death and survival for an indefinite period.

534.43 : 621.395.61 : 681.85 **934**

Pickups.—In future, the U.D.C. number 681.85 will be used for pickups in place of 621.395.61 : 534.43 used hitherto.

534.43 : 681.85 : 564.431.82 **935**

Ceramic Phonograph Pickup.—L. G. Hector & H. W. Koren. (*Electronics*, Dec. 1948, Vol. 21, No. 12, pp. 94–96.) A pickup unaffected by humidity or normal temperature changes uses two ceramic $BaTiO_3$ strips which are mounted between three electrodes and made piezoelectric by applying h.v. See also 1087 below.

534.845.1 : 534.373 **936**

A Simple Arrangement for Measuring Sound Absorption at Low Frequencies.—D. H. Bekkering & C. W. Kosten. (*Appl. sci. Res.*, 1948, Vol. B1, No. 3, pp. 205–212.) A valve voltmeter measures the variation in voltage across a loudspeaker, through which flows a constant current, as the position of the loudspeaker in an interferometer tube is altered relative to the sample under test. The loudspeaker impedance and the absorption coefficient of the sample are deduced. The absorption coefficients of a sample of pressed cork, and of a wood fibre plate, are tabulated for frequencies between 120 and 300 c/s. See also 2145 of 1948 (Kosten).

534.86 **937**

Distortion: Does It Matter?—(*Wireless World*, Jan. 1949, Vol. 55, No. 1, pp. 11–12.) Further discussion at I.E.E. meeting. See also 2149 of 1948.

621.395.61/.62 **938**

An Electrokinetic Transducer.—M. Williams. (*Rev. sci. Instrum.*, Oct. 1948, Vol. 19, No. 10, pp. 640–646.) The electrokinetic potential developed by the movement of a fluid through a porous solid is used to transform sonic into electrical energy. Construction and calibration of the transducer are discussed.

621.395.61/.62 **939**

Theory of Passive Linear Electroacoustic Transducers with Fixed Velocity Distributions.—L. L. Foldy. (*J. acoust. Soc. Amer.*, Jan. 1949, Vol. 21, No. 1, p. 57.) Summary of Acoustical Society of America paper. See also 1990 of 1947 (Primakoff & Foldy).

621.395.61/.62 : 025.4 **940**

Classification of Electroacoustic Transducers.—F. A. Fischer. (*Frequenz*, July 1948, Vol. 2, No. 7, pp. 181–190.) Discussion of various methods of transforming electrical energy into acoustic energy, and vice versa; transducers are arranged in two groups, with three classes in each group. See also 736 of 1942 (Hecht).

621.395.61/.62 : 537.228.1 : 546.431.82 **941**

New Synthetic Piezoelectric Material.—Howatt, Crownover & Drametz. (*See* 1087.)

621.395.625.2 **942**

The Design of a High-Fidelity Disc Recording Equipment.—H. Davies. (*J. Instn. elect. Engrs*, Part III, Nov. 1948, Vol. 95, No. 38, pp. 467–470.) Discussion on 17 of 1948.

621.395.625.3 **943**

Magnetic Recording for the Technician.—D. O'Dea. (*J. Soc. Mot. Pict. Engrs*, Nov. 1948, Vol. 51, No. 5, pp. 468–480.) A review of magnetic-recording theory, with experimental input/output, frequency-response and distortion data obtained with the new R.C.A. recording equipment.

621.395.667 **944**

Versatile Tone Control.—W. B. Lurie. (*Electronics*, Dec. 1948, Vol. 21, No. 12, pp. 81–83.) Treble and bass frequencies are independently boosted or attenuated in steps to provide 121 different response-curve combinations for reproduction of speech or music.

AERIALS AND TRANSMISSION LINES

621.392.26† **945**

Wave-Guide Modes.—E. M. Wells. (*Marconi Rev.*, Oct./Dec. 1948, Vol. 11, No. 91, pp. 124–136.) A general elementary discussion, with perspective diagrams showing the field configuration of various modes, for both rectangular and circular waveguides.

621.392.26† **946**

On the Excitation of Waveguides: Part 3.—A. A. Samarski & A. N. Tikhonov. (*Zh. tekh. Fiz.*, July 1948, Vol. 18, No. 7, pp. 971–985. In Russian.) The radiation resistance of a current is defined; methods of calculation are described and applied, with the aid of Poynting's theorem, to currents in a plane perpendicular to the waveguide axis and also to currents disposed arbitrarily. The results so obtained can also be derived by the method of induced electromotive forces; they are compared with the results of Schelkunoff and Slater. Part 2: 3335 of 1948.

621.392.26† **947**

Reflection of Electric Waves at a Capacitive Diaphragm in a Rectangular Waveguide.—K. Fränz. (*Arch. elekt. Übertragung*, April/May 1948, Vol. 2, Nos. 4/5, pp. 140–147.) The reflection coefficient can be derived by a simple frequency transformation from that for the corresponding case of a diaphragm between two conducting planes. The limiting frequency for the waveguide corresponds to the zero frequency for the plane case, for which the reflection coefficient is easily calculated from the e.s. field.

621.392.26† : 621.3.09 **948**

Wave Propagation in Nearly Circular Waveguides and Arrangements for Transmitting H_0 Waves round Bends.—M. Jouguet. (*Câbles & Transmission, Paris*, Oct. 1948, Vol. 2, No. 4, pp. 257–284. With English summary.) Full paper. For the principal results see 2720 and 2724 of 1948.

621.396.67 **949**

On the Approximate Ground-Absorption Formula for Vertical Dipoles.—K. F. Niessen. (*Physica, 's Grav.*, Nov. 1942, Vol. 9, No. 9, pp. 915–922. In German.) A formula previously given (19 of 1936) contained an error, as was shown by Sommerfeld & Renner (3583 of 1942). Corrected curves are now given.

621.396.67 **950**

On the Illustration of Dipole Radiation.—F. Kiebitz. (*Arch. elekt. Übertragung*, Feb./March 1948, Vol. 2, Nos. 2/3, pp. 49–57.) The Hertzian solution of the field equations is expanded numerically and the results are used to obtain accurate pictures of the development of the radiation field near the dipole.

621.396.67 **951**

On the Choice of Integration Paths in the Problem relating to the Radiation of a Dipole above a Plane Earth.—G. Eckart & T. Kahan. (*C. R. Acad. Sci., Paris*, 8th Nov. 1948, Vol. 227, No. 19, pp. 969–970.)

621.396.67 **952**

An Omnidirectional, Vertically Polarized, Four Element Antenna Array.—R. S. Rettie. (*Canad. J. Res.*, Oct. 1948, Sec. F, Vol. 26, No. 10, pp. 457–463.) Each element is a cylindrical $\lambda/2$ radiator surrounding a mounting pipe. A gain of 4 db over a $\lambda/2$ dipole is obtained. Operation is possible over a 10% frequency band for a centre frequency of 223 Mc/s.

621.396.67 **953**

Hallén's Theory for a Straight, Perfectly Conducting Wire, used as a Transmitting or Receiving Aerial.—C. J. Bouwkamp. (*Physica, 's Grav.*, July 1942, Vol. 9, No. 7, pp. 609–631. In English.) Hallén's general theory is simplified for the case of a straight uniform wire of infinite conductivity. From Maxwell's equations and the boundary conditions at the surface of the wire, the current distribution and hence the aerial field can be computed. The large constant Ω [$= 2 \log (2l/a)$, where $2l$ and $2a$ are respectively the length and diameter of the wire] is involved in a fractional formula for the aerial input impedance, both the numerator and denominator being given by power series in Ω^{-1}. Numerical values of the coefficients of Ω^{-1} and Ω^{-2} are given, so that for $0 \leqslant 2\pi l/\lambda \leqslant 5$ the aerial impedance can easily be computed ($\Omega > 10$). The wavelength and radiation impedance at the first and second point of resonance are given, the calculations including the second-order corrections for the finite diameter of the wire. If used as a receiving aerial, the wire is supposed to be parallel to the incoming electric field. An aerial form factor is defined. The loaded receiving aerial behaves as a generator with internal impedance equal to the input impedance of the wire when used as a transmitting aerial.

621.396.67 **954**

WEWS TV Antenna Installation.—J. B. Epperson. (*Broadcast News*, Oct. 1948, No. 51, pp. 66–71.) A R.C.A. Type TT-3A Super Turnstile is fixed 1 526 ft above sea level, at the top of a 388-ft mast. Radiated power is 16.3 kW peak-to-peak for video and 10.3 kW for f.m.

621.396.67 **955**

The Aerial in Television.—A. Coudert & A. Orlowski. (*Radio tech. Dig., Édn franç.*, Oct. 1948, Vol. 2, No. 5, pp. 225–236.) General discussion of radiation patterns, aerial gain, feeders and impedance matching, with illustrations of various types of television aerials. Part 2: 956 below.

621.396.67 **956**

The Aerial in Television.—A. Coudert & A. Orlowski. (*Radio tech. Dig., Édn franç.*, Dec. 1948, Vol. 2, No. 6, pp. 287–294.) Discussion of (*a*) multi-element aerials, (*b*) a systematic study of reception conditions in and near Paris by means of a mobile receiver, (*c*) two types of French aerial, one being light and suitable for the Paris neighbourhood while the other is designed for long-distance reception. Part 1: 955 above.

621.396.67 **957**

Multi-Slot Aerials.—Ya. N. Fel'd. (*Zh. tekh. Fiz.*, Oct. 1948, Vol. 18, No. 10, pp. 1265–1272. In Russian.) Aerials consisting of non-symmetrical slots cut in a closed metallic surface and excited from either the inside or the outside are considered. A system of integro-differential equations (7) is derived determining the voltage distribution along the slots for any method of excitation. A general method of solving these equations is proposed and the case of 'tuned' aerials is discussed in detail. A formula (21) determining the radiated power of a transmitting aerial is also derived. For earlier work see 3344 of 1948.

621.396.671 **958**

The Patterns of Slotted-Cylinder Antennas.—G. Sinclair. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1948, Vol. 36, No. 12, pp. 1487–1492.) Formulae for the amplitude and relative phase of the field, and calculated patterns for one- and two-slot aerials of varying diameter are given. The results do not indicate relative gains. Increased directivity is obtained by increasing cylinder diameter or by suitable angular arrangement of two or more slots. Experimental results confirm calculated patterns.

621.396.671 **959**

Rhombic Aerial Design Chart.—R. H. Barker. (*Radio tech. Dig., Édn franç.*, Dec. 1948, Vol. 2, No. 6, pp. 263–271.) French version of 649 of March.

621.396.671 **960**

On the Theory of Coupled Antennae.—C. J. Bouwkamp, (*Philips Res. Rep.*, June 1948, Vol. 3, No. 3, pp. 213–226.) A treatment of coupling between two identical, parallel, perfectly conducting cylindrical wires, separated by a distance large compared with the radius of either, and each fed at the centre by a 'slice' generator. Approximate integral equations are obtained and solved for the currents in the two wires. Expressions are then derived for the input and mutual impedances. Some functions involved in the problem are tabulated. See also 3474 of 1944 (King & Harrison).

621.396.671 **961**

Aerial Absorption Surfaces and their Measurement for Decimetre and Centimetre Waves.—R. Becker. (*Arch. elekt. Übertragung*, April/May 1948, Vol. 2, Nos. 4/5, pp. 120–123.) The absorption surface is defined and the formulae required for its determination are deduced. A method of measurement, based on principles given by Fränz (2898 of 1944), is described which only requires the measurement of two lengths and a single transmission-line voltage ratio. The absorption surface of a paraboloid of diameter 80 cm and focal length 20 cm, for $\lambda = 10$ cm, was found to be 2 800 cm², the so-called surface efficiency being 56%.

621.396.675 **962**

Investigation of the Properties of a Ground Aerial.—A. E. Pannenborg. (*Appl. sci. Res.*, 1948, Vol. B1, No. 3, pp. 213–240.) Theoretical results are compared with 3.5-Mc/s field-strength measurements. Measurements on ground waves agree very well with the theory, but the behaviour of horizontally polarized waves is not fully understood.

621.396.676 : 621.396.93 **963**

Some Principles underlying the Design of Aerial Systems for High-Frequency Radio Direction-Finders in H.M. Ships.—Crampton, Struszynski, de Walden & Redgment. (*See* 1075.)

621.396.67 **964**

Antenna Manual. [Book Review]—W. Smith. Editors and Engineers, Santa Barbara, California, 1948, 301 pp. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1948, Vol. 36, No. 12, p. 1511.) ". . . recommended for those desiring a readable, elementary and concise discussion of some of the more practical aspects of radio propagation antennas."

CIRCUITS AND CIRCUIT ELEMENTS

621.3.015.3 : 621.392 **965**

On Transients in Homogeneous Ladder Networks of Finite Length.—W. Nijenhuis. (*Physica, 's Grav.*, Sept. 1942, Vol. 9, No. 8, pp. 817–831. In English.) For all finite homogeneous ladder networks consisting of lumped elements, the solution can be written in such a way that the analogy with the solutions of d'Alembert and Bernoulli is clearly apparent. By comparison of the two forms of solution, new approximations for some functions can be determined, such as Bessel functions in which the argument and order are equal. The formulae obtained are applied to a low-pass and a diffusion filter.

621.3.015.3 : 621.392.52 **966**

Repeated Integrals of Bessel Functions and the Theory of Transients in Filter Circuits.—J. C. Jaeger. (*J. Math. Phys.*, Oct. 1948, Vol. 27, No. 3, pp. 210–219.) The solution for the simple high-pass filter, given by Carson & Zobel in 1923, involves a sum of repeated integrals of Bessel functions of order zero. This solution is regarded as a new 'high-pass filter function', and is tabulated. Solutions for certain more complicated ladder networks can be expressed in terms of this function. The solutions of a number of transient problems in the ten simplest semi-infinite ladder networks can be expressed as single integrals involving tabulated functions.

621.3.018.4(083.74) **967**

Ultrasonic Generator with Standard Frequency.—A. Barone. (*Helv. phys. Acta*, 15th June 1948, Vol. 21, No. 2, pp. 137–142. In German.) Details of a quartz-controlled 1-Mc/s generator with additional stages for 2 Mc/s and 4 Mc/s. The output from the 4-Mc/s stage is 18–20 W. The variation of the fundamental frequency with the temperature of the crystal is determined by comparison of its tenth harmonic with WWV 10-Mc/s transmissions.

621.314.2 **968**

Methods for Designing High-Power Modulation Transformers.—S. V. Person, M. A. Sobolev & N. I. Eydlin. (*Radiotekhnika, Moscow*, Sept./Oct. 1948, Vol. 3, No. 5, pp. 3–23. In Russian.) Technical requirements imposed on modulation transformers are reviewed and two modulation circuits, one with and one without a modulation choke, (Figs 1 and 2) are considered. The design of transformers for each of the above circuits is discussed and a simple method is proposed for determining the maximum magnetic induction of the transformer so as not to exceed the permissible distortion. The design of the modulation choke is also examined. Numerical examples are given. The two modulation circuits are compared. A great saving in weight can be effected if a circuit with a choke is used in broadcasting transmitters. For commercial transmitters the circuit without choke is preferable.

621.314.2 : 621.396.93 **969**

An Investigation of Symmetrical Screened Transformers for H.F. Radio Direction-Finders.—W. Struszynski & J. H. Marshall. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 857–867.) Discussion of: (*a*) the equivalent circuit theory of such transformers, (*b*) the symmetry factor, (*c*) experimental evidence in support of the theory, (*d*) the principles of mechanical design, (*e*) methods of balancing, and (*f*) results of measurements of the symmetry factor for two typical transformers.

621.314.2.012 **970**

Diagrams for Output Transformer Design Calculations.—J. Sommer. (*Funk u. Ton*, Nov. 1948, Vol. 2, No. 11, pp. 549–563.) The diagrams enable transformer data to be found for a given power loss in the transformer and for a given lower limit of the frequency band to be used. In addition to the core dimensions, other details such as airgap, winding data and size of wire are given. The characteristics of the output valve must be known. The diagrams apply to standard E and M stampings of grade-IV dynamo sheet and can also be used for filter-choke calculations.

621.314.3† **971**

Magnetic Amplifiers.—(*Elect. Times*, 9th Dec. 1948, Vol. 114, No. 2979, pp. 699–701.) Summary and discussion of two I.E.E. papers entitled "Magnetic Amplifiers", by A. G. Milnes, and "A Theoretical and Experimental Study of the Series-Connected Magnetic Amplifier", by H. M. Gale & P. D. Atkinson.

621.316.727 **972**

On a Method of Phase-Shift Control for Auxiliary-Circuit Supplies.—R. Matthäi. (*Brown Boveri Rev.*, May/June 1948, Vol. 35, Nos. 5/6, pp. 157–161.) Essentially a simple bridge circuit for obtaining an a.c. voltage whose phase angle with respect to the supply can be made to have any value between 0 and 180°. Families of circle diagrams are derived for some characteristic cases, and their application is explained by means of numerical examples.

621.316.935.1 : 518.4 **973**

Graphical Iron Core Reactor Design.—M. R. Whitman. (*Electronics*, Dec. 1948, Vol. 21, No. 12, pp. 136..148.)

621.318.572 **974**

Coincidence Device of 10^{-8}-10^{-9} Second Resolving Power.—Z. Bay & G. Papp. (*Rev. sci. Instrum.*, Sept. 1948, Vol. 19, No. 9, pp. 565–567.) For another account see 2471 of 1948.

621.318.572 **975**

Coincidence Circuit of Medium Resolution.—H. L. Schultz & E. Pollard. (*Rev. sci. Instrum.*, Oct. 1948, Vol. 19, No. 10, pp. 617–620.)

621.318.572 **976**

Investigations on Various Coincidence Mixer Stages.—P. Stoll, M. Walter & W. Zünti. (*Helv. phys. Acta*, 10th Aug. 1948, Vol. 21, Nos. 3/4, pp. 177–179. In German.) Summary of Swiss Phys. Soc. paper.

621.318.572 **977**

On Scaling-Down Circuits.—E. Baldinger & R. Casale. (*Helv. phys. Acta*, 15th June 1948, Vol. 21, No. 2, pp. 117–130. In German.) All see-saw circuits can be used either as generators, flip-flops or scaling-down circuits if the circuit constants are suitably chosen. The design of a simple multivibrator type of scaling-down circuit is discussed and approximate formulae are given for the calculation of the various circuit constants. An input stage is described suitable for counting voltage impulses of any waveform. A detailed circuit diagram is given for a scale-of-128 circuit with a resolving power of 1 μs.

621.319.4 : 551.57 **978**

The Effect of Humidity on the Calibration of Precision Air Capacitors.—L. H. Ford. (*J. Instn elect. Engrs*, Part II, Dec. 1948, Vol. 95, No. 48, pp. 709–712.) Over the range of relative humidity 30–65%, the total change in capacitance can be about 3 parts in 10^4 at room temperature.

621.392 **979**

On the Properties of the General Mesh Network with Structural Symmetry.—G. Nasse. (*C. R. Acad. Sci., Paris*, 20th Dec. 1948, Vol. 227, No. 25, pp. 1350–1352.) Matrix theory for a system satisfying the following conditions: (*a*) it has two groups of $n + 1$ terminals, (*b*) it contains $m \times n$ independent meshes and constitutes the extension, to a system of n phases, of a network of m geometrically independent meshes, (*c*) it possesses a symmetry of structure such that a circular permutation of the voltages applied to its terminals causes an identical permutation of the currents entering by these terminals.

621.392 **980**

The Gyrator, a New Electric Network Element.—B. D. H. Tellegen. (*Philips Res. Rep.*, April 1948, Vol. 3, No. 2, pp. 81–101.) The 'gyrator' is a linear, constant passive network element which violates the reciprocity relation. It 'gyrates' a current into a voltage or vice versa. Network synthesis is much simplified by including such elements, which can be realized by means of a medium consisting of particles carrying both permanent electric and permanent magnetic dipoles, or by means of a type of gyromagnetic effect in a ferromagnetic medium.

621.392.43 **981**

A Universal Adjustable Transformer for U.H.F. Work.—J. M. van Hofweegen & K. S. Knol. (*Philips Res. Rep.*, April 1948, Vol. 3, No. 2, pp. 140–155.) A device for matching any two impedances by the proper adjustment of two shorting bridges. It consists of a screened 2-wire Lecher system asymmetrically loaded with respect to the screen. The device can also be used for rough impedance measurements. A universal adjustable waveguide transformer based on the same principle is also discussed.

621.392.43 **982**

A Single-Control Variable-Frequency Impedance-Transforming Network.—A. Bark. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1948, Vol. 36, No. 12, pp. 1535–1537.) Mathematical analysis of a coaxial-line network, based on the stub matching method, which will maintain perfect matching of generator to load over a wide range of frequencies by adjustment of a single reactance shunted across the load. Design formulae are derived and an equivalent circuit is illustrated. Transformers of this type have been built to match aerial cables to mixers of colour television receivers operating over the range 480–920 Mc/s. Noise and losses due to sliding contacts are avoided. By ganging the shunt reactance to the local oscillator, matching was automatically achieved at any frequency in the tuning range.

621.392.5 **983**

The Calculation of Attenuators.—K. Martin. (*Funk u. Ton*, Nov. 1948, Vol. 2, No. 11, pp. 591–595.) Formulae and tables are given which greatly simplify the determination of the values of the various components of *T*- and *Π*-attenuators.

621.392.5 **984**

Insertion and Echo Loss for No-Load Quadripole.—W. Herzog. (*Arch. elekt. Übertragung*, Feb./March 1948, Vol. 2, Nos. 2/3, pp. 84–87.) Formulae for these losses are given and applied to a crystal band-filter.

621.392.52 **985**

Insertion Characteristics of Filters: Part 2—'Constant-*k*', 'M-Derived' Sections and Composite Filters.—J. B. Rudd. (*A.W.A. tech. Rev.*, Oct. 1948, Vol. 8, No. 1, pp. 77–95.) Previous results (1697 of 1947) are modified to apply to multi-section, constant-*k* filters terminated by resistances other than their design resistance. Expressions are developed for *m*-derived single-section filters and for composite filters consisting of prototype sections together with *m*-derived sections. Insertion loss and insertion phase-shift characteristics for some composite filters are shown graphically and formulae for the loss and phase shift are summarized and tabulated. The frequency variable used is such that the results obtained may be applied to low-pass, high-pass and confluent bandpass filters.

621.396.611 **986**

On a Simple Statistical Property of an Ensemble of Linear Harmonic Oscillators.—R. Kronig. (*Physica, 's Grav.*, Jan. 1942, Vol. 9, No. 1, pp. 113–116. In English.) For a system of oscillators of given frequency in thermal equilibrium, the distribution of the deviations from the 'rest' state is Gaussian.

621.396.611 : 621.316.726 **987**

Practical Notes on the Maintenance of Frequency Constancy for Spherical Resonators.—K. F. Niessen. (*Physica, 's Grav.*, July 1942, Vol. 9, No. 7, pp. 768–772. In German.) For the suppression of frequency variations due to expansion caused by Joule heating of the resonator walls, two alternative methods are recommended: (*a*) fixing the resonator between two diametrically opposed blocks whose separation does not vary with temperature, with the halves of the dipole at the ends of the diameter joining the blocks, (*b*) fixing a ring of invariable diameter round the resonator, with the halves of the dipole at the ends of a diameter of the ring. See also 992 below.

621.396.611.1 **988**

On the van der Pol Oscillator.—N. Minorsky. (*C. R. Acad. Sci., Paris*, 3rd Jan. 1949, Vol. 228, No. 1, pp. 60–61.) Theoretical discussion of the oscillator defined by the equation $\ddot{x} - \epsilon\,(1 - x^2)\,\dot{x} + x = 0$.

621.396.611.1 : 518.4 **989**

Graphical Determination of Oscillation Phenomena in Oscillatory Systems by means of Complex Representation.—H. Kleinwachter & H. Wojtech. (*Arch. elekt. Übertragung*, Feb./March 1948, Vol. 2, Nos. 2/3, pp. 69–75.) A particular advantage of the method is the fulfilment of the boundary conditions by the use of a logarithmic spiral as the solution function. When damping is absent the spiral degenerates into a circle. Use of a sufficiently finely divided step function for the input signal enables an approximate solution of the differential equation to be obtained.

621.396.611.21 **990**

The Equivalent Circuit of the Curie Double Strip.—E. J. Post. (*Appl. sci. Res.*, 1948, Vol. B1, No. 3, pp. 168–180.) A dynamic theory is given. The equivalent constants for the bending mode are closely related to those of the corresponding longitudinal vibration. Results based on the theory are compared with Dutch Post Office experimental results and with those of Lane (1582 of 1946).

621.396.611.21 **991**

Methods for Varying the Resonance Frequency of Crystal Oscillators.—W. Herzog. (*Arch. elekt. Übertragung*, April/May 1948, Vol. 2, Nos. 4/5, pp. 153–163.) Discussion of the limits of the possible frequency variation and also of variation arrangements making use of capacitors or inductors, either in series or in parallel with the crystal. With some of these methods the frequency variation can be extended considerably.

621.396.611.4 **992**

Mean Frequency Stability of Cavity Resonators.—K. F. Niessen. (*Physica, 's Grav.*, Feb. 1942, Vol. 9, No. 2, pp. 145–157. In German.) A general discussion for the case where deformation of the resonator is limited to extension. For the sphere and cube the stability differs very little from that for deformations such that the surface area remains constant. See also 3369 of 1948 and 993 below.

621.396.611.4 **993**

On the Frequency Stability of Some Cavity Resonators in an Electrical Circuit.—K. F. Niessen. (*Physica, 's Grav.*, June 1942, Vol. 9, No. 6, pp. 539–546. In German.) Calculations for the sphere and the cube show that in general the cube has the smaller frequency variations for small irregular deformations. See also 992 above.

621.396.611.4 **994**

Nodal Planes in a Perturbed Cavity Resonator: Part 1.—K. F. Niessen. (*Appl. sci. Res.*, 1948, Vol. B1, No. 3, pp. 187–194.) The resonator considered is a rectangular cavity of square cross-section, with one of its walls rotated through a small angle about its edge, the electric vector being parallel to this edge. The change in resonance frequency, and the distortion of the electric field, for the fundamental vibration, due to the asymmetry of the cavity, are investigated mathematically.

621.396.611.4 **995**

On the Forced Electro-Magnetic Oscillations in Spherical Resonators.—O. E. H. Rydbeck. (*Phil. Mag.*, Aug. 1948, Vol. 39, No. 295, pp. 633–644.) Electromagnetic oscillations in spherical systems are studied as functions of the exciting source, and the solutions obtained show the degree of excitation of the various modes and orders. Transverse electric (TE) waves and transverse magnetic (TM) waves are studied separately, and the equivalent network for a resonator with two current loops is shown.

621.396.611.4 **996**

A Method for Approximate Calculation of Natural Wavelengths of Cavity Resonators of Irregular Shapes.—G. V. Kisun'ko. (*Radiotekhnika, Moscow*, Sept./Oct. 1948, Vol. 3, No. 5, pp. 24–35. In Russian.) The resonator under investigation is divided into a number of simple regions and the proper (eigen) functions of the resonator are expressed approximately in terms of the proper functions of these regions. Conventions necessary in using this method are discussed and a conception of average boundary conditions between the regions is introduced. The case of free e.m. oscillations in dielectric volumes bounded by ideally conducting cylindrical envelopes is considered in detail. The method is also applied to a system of parallel cylinders coupled by longitudinal slots.

621.396.611.4 **997**

Experiments on Cylindrical Cavity Resonators.—D. D. Mansion. (*Rev. telegr., Buenos Aires*, Sept. 1948, Vol. 37, No. 432, pp. 631–634, 670.) Results of measurements are given for the resonance wavelength of a resonator as a function of the length and diameter of a central piston, and for the Q factor for various cylinder lengths. A double-beat method for measurement of the frequency excursion is also described.

621.396.615 : 537.525.92 **998**

Space-Charge Control in the Transit-Time Region with High Degree of Modulation.—F. W. Gundlach. (*Funk u. Ton*, Aug.–Oct. 1948, Vol. 2, Nos. 8–10, pp. 407–419, 454–465 & 516–530.) Analysis for the plane diode, assuming that the initial velocity of electrons leaving the cathode is zero, that saturation does not occur, and that the current flowing across the discharge path is sinusoidal. For an oscillating diode the optimum efficiency is only about 3%, so that the resonance resistance of the attached resonator must be about 4 times greater than that necessary for oscillation. With space-charge control the slope of the characteristic falls with increased transit angle and with increased modulation; the control power decreases, on the average, with increased transit angle. In the transit-time region a diode can absorb real power when the anode voltage is made so negative that the anode d.c. vanishes. Theoretical results are supported by calculation of electron paths, agreement being exact in many cases and closely approximate in others. The degree of approximation is discussed and a complete review of the physical phenomena in the space-charge diode is given. The behaviour of the electron current and of the a.c. and d.c. voltages is shown graphically and the special case where the anode current has no d.c. component is discussed.

621.396.615.029.63 **999**

The Self-Excitation of a Triode Oscillator with Feedback in the Decimetre Wavelength Range.—S. D. Gvozdover & V. A. Zore. (*Zh. tekh. Fiz.*, Sept. 1948, Vol. 18, No. 9, pp. 1194–1206. In Russian.) The self-excitation of a triode is investigated mathematically, taking into account the cathode-grid transit time General formulae are derived for determining the wavelength of the oscillator, the condition of self-excitation and the frequency correction necessary for u.s.w. operation. The theory is illustrated by an analysis of the self-excitation of the Esau circuit (Fig. 4).

621.396.619.13 : 621.396.621 **1000**

Crystal Discriminators.—J. M. Barcala. (*Rev. telegr., Buenos Aires*, Sept. 1948, Vol. 37, No. 432, pp. 611–615, 648.) Discussion of their characteristics, with special reference to (*a*) operating voltages and their variation with frequency, (*b*) sensitivity, (*c*) effect of the Q factor of the tuned circuit, (*d*) effect of voltage ratio on output.

621.396.619.13 : 621.396.621 **1001**

A Phase Discriminator for Frequency-Modulation Reception.—F. G. Newall & J. G. Spencer. (*Electronic Engng*, Jan. 1949, Vol. 21, No. 251, pp. 25–26.) Description of a circuit which is easy to align and produces an output voltage high enough to drive a normal output valve. A circuit diagram is given and design data are discussed.

621.396.645 + 621.392.52 **1002**

The Properties of I.F.-Amplifier Networks.—A. Lennartz. (*Funk u. Ton*, Nov. 1948, Vol. 2, No. 11, pp. 579–590.) Equivalent circuits are used in discussion of various types of amplifiers and filters.

621.396.645 **1003**

Study and Construction of an Amplifier of Very High Quality : Parts 1 & 2.—F. Gilloux. (*Radio prof. belge*, April & Oct. 1948, Vol. 11, Nos. 43 & 47, pp. 13–18 & 16–18.) Discussion of the design of the different stages of an amplifier in which phase distortion is low and which has an extended range of uniform response. Construction details are given.

621.396.645 : 621.316.722.4 **1004**

Low-Impedance Variable Voltage Tappings.—M. G. Scroggie. (*Wireless World*, Jan. 1949, Vol. 55, No. 1, pp. 2–6.) A cathode follower can be controlled to provide a continuously variable output when shunted across a stabilized d.c. supply voltage. The cathode follower has an internal resistance which for most applications is $<1\%$ of the load resistance into which it has to work. Circuit and operational details are discussed. The limitations on the output are those imposed by the characteristics of the valve used and its maximum loadings. For previous parts see 231 of January, 863 of March and 1200 below.

621.396.645 : 621.385 : 621.396.822 **1005**

On the Influence of the Noise of Vacuum Tubes on the Accuracy of Linear Amplifiers.—Milatz & Keller. (*See* 1229.)

621.396.645 : 621.396.931 **1006**

Power Amplifier for the Citizens Transmitter.—W. C. Hollis. (*Electronics*, Dec. 1948, Vol. 21, No. 12, pp. 84–87.) Construction and circuit details of a two-stage amplifier for use with the transmitter discussed in 855 of 1948. No machining is necessary. See also 3511 of 1948 (Lurie) and back references.

621.396.645.001.8 : 535.6 **1007**

Applications of Alternating Current Amplifiers to Optical Measurements.—E. J. Harris. (*Electronic Engng*, Dec. 1948, Vol. 20, No. 250, pp. 396–399.) An absorptiometer and two spectrometers are briefly discussed. Requirements concerning detector impedance, switching frequency of an interrupted beam, and tuning are considered.

621.396.645.029.4 : 621.314.2 **1008**

Note on A.F. Amplification : the Question of the Transformer.—H. Gilloux. (*Radio franç.*, Oct. 1948, pp. 10–13.) An extremely simple method of design is given for the transformer of an output stage using a single power valve or two smaller valves in parallel. Examples show that for a corresponding push-pull stage the transformer is very much heavier and about 4 times dearer. See also 1321 of 1948.

621.396.645.37 **1009**

Cascade-Connected Feedback Amplifiers.—H. Mayr. (*Microtecnic, Lausanne*, Aug. 1948, Vol. 11, No. 4, pp. 174–178. In English.) The complex attenuation/frequency characteristic of an n-stage amplifier is discussed, particularly for $n \leqslant 4$. It is not possible to obtain a rectangular attenuation curve if all the stages are tuned to the same frequency, while detuning the stages involves a considerable reduction in gain. A better solution is offered by subdividing the whole amplifier into groups of one or two stages, each with its own feedback loop; this possibility is discussed in detail for 3- and 4-stage amplifiers.

621.396.645.37 : 621.3.011.3/.4 **1010**

High-Q Variable Reactance.—J. N. Van Scoyoc & J. L. Murphy. (*Electronics*, Jan. 1949, Vol. 22, No. 1, pp. 118–122.) The basic circuit consists of a feedback amplifier with a reactance in the feedback loop. The Q of the circuit is high if the amplifier output impedance is small compared with the feedback reactance. The overall reactance may be varied by changing the amplifier gain, which may be controlled by an applied signal, by a potentiometer, or by changing valve transconductance or load resistance in one or more stages of the amplifier. A double-triode cathode-follower circuit is discussed in which the second cathode follower is used as a variable load resistance for the first.

621.396.645.37 : 621.396.619.231 **1011**

Valve Characteristic Giving Linear Modulation when a Feedback Resistor is Inserted in the Cathode Lead.—Boelens. (*See* 1246.)

621.396.645.371 **1012**

Impedances in the Feedback Amplifier.—P. M. Prache. (*Bull. Soc. franç. Élect.*, Nov. 1948, Vol. 8, No. 86, pp. 531–535.) Discussion on 383 of 1948. See also 1329 of 1948.

621.396.645.371 **1013**

Corrector Circuits for Feedback Amplifiers.—H. Chireix. (*Bull. Soc. franç. Élect.*, Nov. 1948, Vol. 8, No. 86, pp. 523–531.) Various circuits are considered, comprising both reactors and resistors, which can be used for control of phase, gain and passband.

621.396.645.371 : 621.317.715 **1014**

Influence of Reactive Feedback Networks on the Response of Galvanometers.—P. Savic. (*Nature, Lond.*, 9th Oct. 1948, Vol. 162, No. 4119, pp. 569–570.) The damping and/or natural frequency of a galvanometer can be altered to an extent proportional to the gain of an associated amplifier which has a suitable reactive feedback circuit.

621.396.69 : 06.064 **1015**

Amateur Radio Show.—(*Wireless World*, Jan. 1949, Vol. 55, No. 1, pp. 13–14.) Brief description of some of the components exhibited.

621.392 **1016**

Microwave Transmission Circuits. [Book Review]—G. L. Ragan (Ed.). McGraw-Hill, New York, 1948, 716 pp., $8.50. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1948, Vol. 36, No. 12, p. 1511.) Volume 9 of the M.I.T. Radiation Laboratory series. " . . . deals with the problems of power transmission from one place to another at microwave frequencies, and its contents are applicable to almost all of the problems that come up in the design of microwave circuits."

GENERAL PHYSICS

53.081 + 621.3.081 **1017**

The Rationalized Giorgi System with Absolute Volt and Ampere as applied in Electrical Engineering.—P. Cornelius. (*Philips tech. Rev.*, Sept. 1948, Vol. 10, No. 3, pp. 79–86.) The most important e.m. formulae are tabulated and discussed.

530.162 : 519.2 **1018**

A Problem on Random Vectors.—R. D. Lord. (*Phil. Mag.*, Jan. 1948, Vol. 39, No. 288, pp. 66–71.) An analysis of the probability distribution of the component, along a given axis, of the sum of a number of equal coplanar vectors whose directions are random. The solutions are expressed in terms of Bessel functions and are generalized for a system in more than two dimensions. See also 3566 of 1947 (Horner).

535 : 52 **1019**

Some Recent Applications of Optics to Astronomy.—E. H. Linfoot. (*Mon. Not. R. astr. Soc.*, 1948, Vol. 108, No. 1, pp. 81–93.) Includes a discussion of the Schmidt optical system.

535.61-15 **1020**

On the Range of Infra-Red Rays.—W. Dechend. (*Elektron Wiss. Tech.*, Nov. 1948, Vol. 2, No. 11, pp. 255–259.) Discussion of experimental results on the relation between the range and (*a*) the power of the source, (*b*) the water-vapour content of the atmosphere and (*c*) the reflecting power of objects.

536.3 **1021**

The Efficiency of Radiation Shields.—A. E. De Barr. (*Rev. sci. Instrum.*, Sept. 1948, Vol. 19, No. 9, pp. 569–573.) " The effect of a number of thick radiation shields of infinite thermal conductivity and of a type realizable in practice is analyzed by matrix algebra, and a method for calculating the temperatures of the various shields is also given." See also 1022 below.

536.3 **1022**

Extension of De Barr's Analysis of Radiation Shielding.—J. B. Garrison & A. W. Lawson. (*Rev. sci. Instrum.*, Sept. 1948, Vol. 19, No. 9, pp. 574–577.) Extension of De Barr's analysis (1021 above) to the case when the original source has arbitrary emissivity.

537.52 **1023**

Mechanism of Dielectric Breakdown.—D. T. Hurd. (*Gen. elect. Rev.*, Dec. 1948, Vol. 51, No. 12, pp. 26–33.) A theoretical discussion for gaseous, liquid and solid dielectrics.

537.525.92 **1024**

Space-Charge Wave Amplification Effects.—A. V. Haeff. (*Phys. Rev.*, 15th Nov. 1948, Vol. 74, No. 10, pp. 1532–1533.) A search for more efficient means of generating and amplifying microwave energy has suggested that the mechanism of interaction between particles and associated space-charge waves is of primary importance in many natural phenomena. The theory of the effect is outlined and its application to effects such as solar noise, excess noise in electron beam tubes and magnetrons, and high temperatures of electron clouds in magnetrons, is considered.

538 : 061.3 **1025**

Magnetism.—D.A.O. (*Nature, Lond.*, 20th Nov. 1948, Vol. 162, No. 4125, pp. 799–801.) Summaries of 3 papers read at a British Association Symposium.

538.566.029.65/.66† **1026**

The Limiting Region between Electromagnetic Millimetre Waves and the Long-Wave Infra-Red.—F. X. Eder. (*Funk u. Ton*, Oct. 1948, Vol. 2, No. 10, pp. 491–498.) A review of methods for generating such waves.

538.569.4 : [546.441.26-145.1 + 546.413.1-145.1 **1027**

Absorption of Ultra High Frequency Waves in Salt Solutions.—S. K. Chatterjee & B. V. Sreekantan. (*Indian J. Phys.*, July 1948, Vol. 22, No. 7, pp. 325–332.) Measurements at frequencies between 300 and 480 Mc/s, using aqueous solutions of $MgSO_4$ and $CaCl_2$ of different concentrations, show that absorption maxima generally shift to higher concentrations with increasing frequency. The reflection coefficient varies little with either concentration or frequency. The results agree with the theory outlined. Experimental details were discussed in 3099 of 1948.

538.569.4.029.65† : 546.21 **1028**

Atmospheric Absorption of Millimetre Waves.—H. R. L. Lamont. (*Proc. phys. Soc.*, 1st Dec. 1948, Vol. 61, No. 348, pp. 562–569.) A brief account of this work was noted in 3398 of 1948. The maximum absorption observed was 15.7 db/km, after reduction to standard dry atmospheric conditions.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

521.1 **1029**

Review of Cosmology.—H. Bondi. (*Mon. Not. R. astr. Soc.*, 1948, Vol. 108, No. 1, pp. 104–120.)

523.2 **1030**

The Origin of the Solar System.—H. Jeffreys. (*Mon. Not. R. astr. Soc.*, 1948, Vol. 108, No. 1, pp. 94–103.)

523.53 : 621.396.9 **1031**

Determination of Meteor Radiants by Observation of Radio Echoes from Meteor Trails.—J. A. Clegg. (*Phil. Mag.*, Aug. 1948, Vol. 39, No. 295, pp. 577–594.) By noting the variations in the ranges in addition to the variations of the hourly rates it is possible to reduce the number of observing stations from three to one. Using a frequency of 70 Mc/s and an aerial system whose half-amplitude beam-width is ± 10°, under favourable conditions the radiant can be located within a circle of radius 1°, but usually the probable errors are greater. See also 3402 of 1948 (Lovell).

523.61 "1947" **1032**

Comets [in 1947].—G. Merton. (*Mon. Not. R. astr. Soc.*, 1948, Vol. 108, No. 1, pp. 124–130.)

523.72 : 621.396.822 : 551.510.535 **1033**

Ionospheric Effects noted during Dawn Observations on Solar Noise.—R. Payne-Scott & L. L. McCready. (*Terr. Magn. atmos. Elect.*, Dec. 1948, Vol. 53, No. 4, pp. 429–432.) A small source of solar noise is observed from a high site at dawn. The direct wave and that reflected from the surface of the sea give an interference pattern from which the apparent elevation of the source can be calculated. The difference between the elevations on 200 and 60 Mc/s gives the ionospheric refraction on the lower frequency and is of the order of ½°. The observed refraction is about three times that expected assuming a symmetrical F layer, but the change with elevation favours an asymmetrical F layer rather than a possible G layer. On several days, noise on 60 Mc/s completely disappeared for some minutes before returning with reduced amplitude. This is tentatively attributed to absorption or refraction effects. See also 412 of 1948 (McCready, Pawsey & Payne-Scott).

523.745 **1034**

Maximum of the Current Cycle of Solar Activity.—V. F. Chistyakov. (*Priroda*, Aug. 1948, No. 8, p. 41. In Russian.)

523.746 : 621.396.822 **1035**

Changes in Ionization and Radio Reception during the Sunspot-Period 1944-1947.—H. T. Stetson. (*Terr. Magn. atmos. Elect.*, Dec. 1948, Vol. 53, No. 4, pp. 449–454.) Discussion of the relation between sunspot number and field strength for 5-Mc/s and 10-Mc/s transmissions over a 373-mile path. The night field for 5 Mc/s has a maximum at a sunspot number of 105, while day fields decreased steadily with increasing sunspot number. For 10-Mc/s transmissions, both day and night fields increased with increasing sunspot number.

523.746 "1947" **1036**

Solar Activity: Sunspots [in 1947].—H. W. Newton. (*Mon. Not. R. astr. Soc.*, 1948, Vol. 108, No. 1, pp. 122–123.)

523.746 "1948.07/.09" **1037**

Provisional Sunspot-Numbers for July to September 1948.—M. Waldmeier. (*Terr. Magn. atmos. Elect.*, Dec. 1948, Vol. 53, No. 4, p. 348.)

523.752 "1947" **1038**

Solar Activity: Prominences [in 1947].—A. K. Das. (*Mon. Not. R. astr. Soc.*, 1948, Vol. 108, No. 1, pp. 123–124.)

538.12 : 521.15 **1039**

Magnetism of Celestial Bodies and Gravitation.—J. Mariani. (*Nature, Lond.*, 16th Oct. 1948, Vol. 162, No. 4120, pp. 612–613.) Discussion of Blackett's formula (3112 of 1947) and Wilson's relation $\sigma = \rho\sqrt{K}$, where the charge density σ is associated with the mass density ρ by the Newtonian gravitational constant K. The Newtonian theory of gravitation fails to explain Wilson's formula. A suggested explanation in terms of relativistic theory is given for the case of an isolated and limited fluid surrounded by a static gravitational field.

538.12 : 521.15 : 523.7 **1040**

Solar Magnetism and the Suggested Fundamental Magnetization by Rotation.—S. Chapman. (*Mon. Not. R. astr. Soc.*, 1948, Vol. 108, No. 3, pp. 236–251.) The assumption (discussed by Blackett in 3112 of 1947) that a rotary mass flux f produces a magnetic field as if it were a negative electric current of intensity $\beta G^{\frac{1}{2}} f/c$ is applied to the sun. Here β is a constant of order unity (0.3 for the earth), G is the gravitational constant and c the velocity of light. The solar density distribution assumed is that of a point convective model having a non-uniform distribution of angular velocity. If the sun's polar magnetic intensity is of the order of 10 gauss, as suggested by Thiessen, β for the sun is about 0.4. The magnetic intensity at the centre of the sun appears to be of the same order of magnitude as sunspot magnetic fields, but these fields may be due to some other mechanism, and this weakens the hypothesis that β is a universal constant. The non-uniformity of angular velocity introduces terms into the field potential which are too small to be observable at present.

550.38 : 523.78 "1947.05.20" **1041**

Magnetic Effects Observed at Vassouras, Brazil, during the Solar Eclipse of May 20, 1947.—L. I. Gama. (*Terr. Magn. atmos. Elect.*, Dec. 1948, Vol. 53, No. 4, pp. 405–428.)

550.38"1948.04/.06" **1042**

Selected Days, Preliminary Mean *K*-Indices and *C*-Numbers for Second Quarter, 1948.—N. F. Eaton. (*Terr. Magn. atmos. Elect.*, Dec. 1948, Vol. 53, No. 4, pp. 477, 478.)

550.38 "1948.07/.09" **1043**

Daily Magnetic-Activity Figures *C* and Three-Hour-Range Indices *K* and List of Sudden Commencements, July to September, 1948, at Abinger.—H. Spencer Jones. (*Terr. Magn. atmos. Elect.*, Dec. 1948, Vol. 53, No. 4, pp. 479–480.)

550.38 "1948.07/.09" **1044**

Cheltenham [Maryland] ***K*-Indices for July to September, 1948.**—P. G. Ledig. (*Terr. Magn. atmos. Elect.*, Dec. 1948, Vol. 53, No. 4, p. 404.)

550.384.3 **1045**

Pre-History of the Earth's Magnetic Field.—E. A. Johnson, T. Murphy & O. W. Torreson. (*Terr. Magn. atmos. Elect.*, Dec. 1948, Vol. 53, No. 4, pp. 349–372.) A study of anomalous deposits in glacial clays and of Pacific cores suggests that the earth's field has remained substantially constant for the last million years.

550.385 "1948.07/.09" **1046**

Principal Magnetic Storms [July–Sept. 1948].—(*Terr. Magn. atmos. Elect.*, Dec. 1948, Vol. 53, No. 4, pp. 481–494.)

551.5 : 538.566 **1047**

Some Problems in Radio Meteorology.—Booker. (*See* 1159.)

551.510.535 **1048**

On the Structure of the Ionosphere.—J. Malsch. (*Arch. elekt. Übertragung*, Feb./March 1948, Vol. 2, Nos. 2/3, pp. 58–69.) If radio waves are reflected from the F layer, or from the E layer and affected by the lower part of that layer or by one still lower, path differences in the reflected beam give rise to interference effects which cause variations of the received field strength. The effect of limitation of the beam on zenith-reflection measurements of intensity by pulse methods is also considered.

551.510.535 **1049**

The Induction of Electric Currents in a Non-Uniform Ionosphere.—A. A. Ashour & A. T. Price. (*Proc. roy. Soc. A*, 7th Dec. 1948, Vol. 195, No. 1041, pp. 198–224.) Calculations are made of the distribution and the magnetic field of the currents induced in a non-uniformly conducting ionospheric shell by an external magnetic field, which is either periodic or subject to sudden changes. Assuming that the initial phase of magnetic storms is due to field changes outside the ionosphere, it is shown that its mean integrated conductivity is probably not much greater than 10^{-7} e.m.u. It is found that electromagnetic shielding by the ionosphere has an important effect on the distribution of field changes observed on the earth, and may lead to an apparent diurnal variation of frequency of occurrence of sudden commencements at a given station. Simple explanations are suggested for some known features of micro-pulsations, and for some well-known phenomena of magnetic disturbance, including Sangster's rotating disturbance vector.

551.510.535 **1050**

An Approximate Solution of the Problem of Path and Absorption of a Radio Wave in a Deviating Ionosphere Layer.—J. E. Hacke, Jr, & J. M. Kelso. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1948, Vol. 36, No. 12, pp. 1477–1481.) The method of approximations previously used for the case of vertical incidence (3115 of 1948) is extended to obtain solutions for oblique incidence, neglecting second-order absorption effects.

551.510.535 : 523.746 **1051**

Critical Frequencies, Sunspots, and the Sun's Ultra-Violet Radiation.—C. W. Allen. (*Terr. Magn. atmos. Elect.*, Dec. 1948, Vol. 53, No. 4, pp. 433–448.) Monthly values of the ratio A of the critical frequency to the critical frequency for zero sunspot number have been averaged for a number of stations and tabulated for the 11-year period 1937–1947. Certain solar features have variations which are correlated with sunspot-number variations but lag behind them; the lag varies from 0.15 month for Ca flocculi to 0.87 month for coronal line.

The relationship between relative ultra-violet intensity S, sunspot number R and the ratio A is of the form $S = (1 + b R) = A^n$ where b and n are constants. Values of b and n obtained from the 1937–1947 observations for the E, F_1 and F_2 regions are compared with those determined from the relation between critical frequency and the sun's zenith distance.

The recombination coefficients for $R = 0$ are found for the E and F_1 regions; the decay coefficient for the F_2 region is found from observations at stations which are relatively free from F_2-region anomalies.

551.510.535 : 525.624 **1052**

Atmospheric Tides in the Ionosphere: Part 3 — Lunar Tidal Variations at Canberra.—D. F. Martyn. (*Proc. roy. Soc. A*, 9th Nov. 1948, Vol. 194, No. 1039, pp. 429–444.) Semi-diurnal lunar variations have been found in the heights and critical frequencies of the E, F_1 and F_2 regions; the harmonic coefficients have been determined. It is deduced that (*a*) the ionospheric lunar variations are caused by ionic drift under the action of the 'dynamo' electric forces, and not by simple tidal rise and fall of isobaric surfaces, (*b*) the lunar magnetic variations are not produced in the E, F_1 or F_2 regions. Part 1: 2421 of 1947. Part 2: 106 of 1948. Part 4: 1053 below.

551.510.535 : 525.624 **1053**

Atmospheric Tides in the Ionosphere: Part 4 — Studies of the Solar Tide, and the Location of the Regions producing the Diurnal Magnetic Variations.—D. F. Martyn. (*Proc. roy. Soc. A*, 9th Nov. 1948, Vol. 194, No. 1039, pp. 445–463.) Solar tidal effects are found in the E, F_1 and F_2 regions. For the F_2 region the amplitudes and phases of certain seasonal semi-diurnal harmonics are determined and used to interpret the global distribution of F_2 ionization. The lunar magnetic variation appears to be produced mainly by currents in the D region, but is opposed by corresponding currents in the E and F_1 regions. This conclusion is checked by considering McNish's evidence of the effects of solar flares on the magnetic variation (10 of 1938). Part 3: 1052 above.

551.510.535 : 551.524 **1054**

Temperature of the Upper Layers of the Atmosphere.—V. A. Baranul'ko. (*Priroda*, May 1948, No. 5, pp. 34–35. In Russian.) Kessenikh & Bulatov suggested the possibility of a relationship between the temperature on the surface of the earth and that of the F_2 layer (2520 of 1945). This was confirmed by Seaton (3123 of 1947) who showed that at noon high temperatures are probable in the E layer (height about 100 km) and that much lower temperatures are probable in the F_1 and F_2 layers (respective heights 200 and 350 km). The F_2-layer temperature seems to be the nearest to that at the surface of the earth. Since there is a definite relationship between the temperature and the ionization density of the reflecting layer, this conclusion is of great practical importance in selecting optimum wavelengths for communication in particular directions.

551.594.11 **1055**

Studies on the Atmospheric Potential Gradient: Part 1 — The Principle of Selection of Electrostatically Quiet Days.—H. Israël & G. Lahmeyer. (*Terr. Magn. atmos. Elect.*, Dec. 1948, Vol. 53, No. 4, pp. 373–386. In German.) General discussion. It is suggested that in addition to potential gradient measurements, the conductivity and/or the vertical current should also be taken into account.

551.594.6 : 621.396.93 **1056**

Sferics.—C. V. Ockenden. (*Met. Mag.*, April 1947, Vol. 76, No. 898, pp. 78–84.) With four stations operating c.r. tube d.f. equipment at a frequency of about 10 kc/s, the British Meteorological Office is able to locate thunderstorms at distances up to 1 000 or 1 500 miles. The equipment is briefly discussed, and results for certain specific days are correlated with other synoptic information.

LOCATION AND AIDS TO NAVIGATION

621.396.9 : 523.53 **1057**

Determination of Meteor Radiants by Observation of Radio Echoes from Meteor Trails.—Clegg. (*See* 1031.)

621.396.93 **1058**

Airborne Automatic Direction-Finders.—K. F. Umpleby. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 693–704.) Discussion of the general principles of direction finders which automatically rotate their loops to the null position; three such systems are described. The American AN/ARN7 radio compass uses an iron-cored loop which is driven by a 2-phase motor supplied from a saturable-core transformer. The saturation is controlled, through thyratrons, by the receiver output. The German Peilgerät VI system also uses an iron-cored loop, driven by a d.c. motor which is controlled, through a Ward-Leonard system and vibrator rectifier, by the receiver output. In the Royal Aircraft Establishment (R.A.E.) direction finder now being developed, the iron-cored loop is driven, through a differential gear, by two continuously running motors. The loop is rotated when the motor speeds differ; static friction is thus eliminated.

621.396.93 **1059**

Radio Direction-Finding by the Cyclical Differential Measurement of Phase.—C. W. Earp & R. M. Godfrey. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 705–721.) If a single vertical aerial element describes a circular path in a horizontal plane, the phase of the signal received will be modulated according to the position of the aerial relative to the direction of arrival of the signal. The same effect can be obtained by successive electronic switching to individual aerials of a set placed at regular intervals round the circumference of a circle. Several types of direction finder using this system, and their advantages over the simple Adcock system, are discussed. Site errors can thus be appreciably reduced.

621.396.93 **1060**

The Extension of Wireless Direction-Finding Techniques to Very High Frequencies for Naval Use.—R. M. Griffith & W. Rosinski. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 727–740.) Discussion of: (*a*) a rotating H-Adcock system suitable, with slight modification of the aerial dimensions, for different bands in the range 30–600 Mc/s, (*b*) a fixed 4-aerial Adcock system for use with a goniometer for the range 30–100 Mc/s, (*c*) a similar system with visual indication, and (*d*) a rotating reflector system for frequencies above 150 Mc/s. Typical bearing correction curves are given for installations in a ship.

621.396.93 **1061**

An Analysis of the Performance of Multi-Aerial Adcock Direction-Finding Systems.—P. G. Redgment, W. Struszynski & G. J. Phillips. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 751–761.) A generalized modification of the conventional 4-aerial Adcock system is considered in which each aerial is replaced by twin elements connected in parallel, and n pairs of such twin elements are used in conjunction with an n-phase goniometer. Improvement upon the usual Adcock system can be obtained in respect of both spacing error and sensitivity, but an increase in the number of aerials above 8 is of little practical advantage since the spacing for small errors approaches the absolute limit of $1.22\,\lambda$. A star connection of aerials provides a correct sense signal only when the aerial spacing is $<0.76\,\lambda$.

621.396.93 **1062**

A Simple Method of Reducing the Polarization Error of a U-Type Adcock Direction-Finder.—H. Fletcher. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 771–782.) Tests with an Army transportable direction finder which had a satisfactorily small polarization error on a site with high conductivity showed that, on a site of very low conductivity, a simple counterpoise of eight radial elements could have an effectiveness comparable with that of more elaborate earthing arrangements. On an average type of unfavourable site, a fourfold reduction in polarization error was obtained, resulting in a performance comparable with that for a very good site. The use of the system described is recommended for all but the best sites, with or without a layer of crushed coke, which is suggested as an alternative to the large circular earth mat often used.

621.396.93 **1063**

The Performance of High-Frequency Direction-Finders in Various Types of H.M. Ships.—C. Crampton, W. Struszynski, J. H. Marshall & J. C. Woolley. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 798–808.) A survey of the problems and errors associated with h.f. d.f. in ships, including: (*a*) choice of aerial systems, (*b*) siting and rigging requirements, and (*c*) calibration and estimation of accuracy. Calibration results and performance curves for typical installations in different ships are analysed, and possible methods of improving performance are discussed.

621.396.93 **1064**

The Development of a High-Frequency Cathode-Ray Direction-Finder for Naval Use.—S. de Walden, A. F. L. Rocke, J. O. G. Barrett & W. J. Pitts. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 823–837.) The operation of the latest design of shipborne equipment for the frequency range 1–24 Mc/s is based on the familiar twin-channel principle. A crossed-loop aerial system is used and sense is determined by causing the output from an omnidirectional aerial to black out one end of the c.r. tube trace. Development problems associated with the balance of the twin amplifiers, the simplification of alignment and operation and the visual presentation of sense are discussed. The performance under operational conditions is described.

621.396.93 **1065**

Medium-Frequency Direction-Finding in H.M. Ships.—G. J. Burtt: R. T. P. Whipple. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 838–856.) Part 1, by G. J. Burtt: A review of the present state of m.f. direction finding in both surface vessels and submarines and of recent advances in equipment. Part 2, by R. T. P. Whipple: A general discussion of the effect on the direction finders of reradiation from the ship's hull and deck structures.

621.396.93 **1066**
Direction-Finding.—W. Ross: C. Crampton. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 867–870.) Discussion on 1955 and 1956 of 1948.

621.396.93 : 519.283 **1067**
Statistical Plotting Methods for Radio Direction-Finding.—R. H. Barfield. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 673–675.)

621.396.93 : 519.283 **1068**
The Estimation of the Probable Accuracy of High-Frequency Radio Direction-Finding Bearings.—W. Ross. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 722–726.) The method is based on the probable value of the variance associated with the observation. Snap bearings are taken over a period of five minutes. The arithmetic mean is taken as the observational bearing. The probable variance is estimated from (*a*) the spread of the observed readings, (*b*) site errors based on the past history of the direction finder, (*c*) the ionospheric lateral deviation based on known data, and (*d*) the observational error based on the flatness of the bearing. In a practical trial of the method good agreement was obtained between the estimated and the actual bearing errors.

621.396.93 : 519.283 **1069**
Statistical Theory of D.F. Fixing.—R. G. Stansfield. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 762–770.)

621.396.93 : 551.508.5 **1070**
Direction-Finding and the Measurement of Wind by Radio.—D. N. Harrison. (*Met. Mag.*, Oct. 1947, Vol. 76, No. 904, pp. 217–225.) A general review of methods used by the British Meteorological Office for heights up to about 20 km. The radiosonde transmitter and Adcock d.f. sets are being replaced by reflectors and radar sets, which give a greater accuracy but, at present, a reduced range of observations when wind velocities are high. Future developments will be directed towards attaining heights up to at least 30 km, higher instrumental accuracy and better automatic operation.

621.396.93 : 551.594.6 **1071**
Sferics.—Ockenden. (*See* 1056.)

621.396.93 : 621.314.2 **1072**
An Investigation of Symmetrical Screened Transformers for H.F. Radio Direction-Finders.—Struszynski & Marshall. (*See* 969.)

621.396.93 : 621.317.324† **1073**
Field-Strength Estimation by Means of High-Frequency Direction-Finders in H.M. Ships.—Crampton & Toczylowski. (*See* 1118.)

621.396.93 : 621.396.611.1 **1074**
The Errors in Bearings of a High-Frequency Direction-Finder caused by Reradiation from a Nearby Vertical Mast.—C. Crampton, R. T. P. Whipple & A. H. Mugridge. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 815–822.) The largest errors occur when the mast is in resonance at the frequency used.

621.396.93 : 621.396.676 **1075**
Some Principles underlying the Design of Aerial Systems for High-Frequency Radio Direction-Finders in H. M. Ships.—C. Crampton, W. Struszynski, S. de Walden & P. G. Redgment. (*J. Instn elect. Engrs*, Part III, Nov. 1948, Vol. 95, No. 38, pp. 437–453.) The chief design problems arise from the existence of the secondary field from the mast on which the d.f. aerial must be placed, and the necessity for long feeders (up to 150 ft) to the receiver. Fixed crossed-loop aerials of the single-turn, screened type are used, directly connected to twin screened feeders, which are coupled to the receiver by means of a transformer. The sense aerial consists of a vertical rod coaxial with the loops and mast, and a counterpoise system immediately below the loops. A test signal for the aerial system is provided from a small loop placed inside the d.f. loops and at 45° to each. A high degree of equivalence of the d.f. loops and symmetry of the whole structure is required; the magnitudes of the errors introduced by departures from the ideal conditions are investigated. The mechanism of aerial effect (non-directional response) and steps taken to reduce it are described. A detailed account of the principles and practice of sense determination is given.

621.396.93 : 621.396.677 **1076**
A Mobile Spaced-Loop Direction-Finder.—F. Caplin & J. H. Bagley. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 676–682.) A direction finder covering the frequency range 2–20 Mc/s and giving a silent arc of $\pm 5^\circ$ for a field strength of 8 μV/m at 2 Mc/s to 2 μV/m at 20 Mc/s. It can be used when high-angle sky waves predominate. Direction and sense finding in one operation by rotating the loops and watching a meter is achieved by using electronic switches to couple a resistance to each loop alternately. The equipment can be transported in a jeep trailer. See also 2780 of 1947 (Ross).

621.396.93 : 621.396.677 **1077**
Developments in H.F. Direction-Finder Shore Stations using Adcock Aerials.—J. F. Hatch. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 683–692.) Experiments on finding the direction of the separate ray components of multi-path telegraphy signals showed that there was no difficulty in obtaining a bearing on the first component to arrive, but for the later signals the sidebands had to be used instead of the carrier; this gave a reduced sensitivity. An aerial balancing unit which enables adjustments to be made with an internal oscillator instead of a portable transmitter is described, also a balanced potentiometer for measuring goniometer errors within 0.1° and an e.s. screen for a goniometer. The performances of four types of direction finder are compared, and a system using an aural null method is discussed. In this system the goniometer can also be rotated and the null observed on a c.r. tube.

621.396.93.029.62 **1078**
The Development of Single-Receiver Automatic Adcock Direction-Finders for Use in the Frequency Band 100-150 Mc/s.—R. F. Cleaver. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 783–797.) The signals from the two directional elements of the elevated H-Adcock aerial system are modulated at different frequencies with suppression of the carrier, which is later restored in constant phase by the addition of a signal from a central omnidirectional aerial. The combined signal is passed through the receiver, whose output contains two a.f. components. Their amplitudes and phases give the bearing and sense of the received signal, which are indicated by a c.r. tube display. Two experimental models, and a naval model based on these, are discussed. The probable instrumental error in the naval model is about 0.6–1.25° after allowing for octantal error. The required field strength is 7 μV/m or less. Instruments for land use are considered; a direction finder capable of unattended operation on two frequency channels and having full remote control facilities is now being developed.

621.396.932 **1079**
Compact Marine Radar.—(*Wireless World*, Jan. 1949, Vol. 55, No. 1, pp. 16–17.) Details are given of the latest Kelvin-Hughes equipment. A rotating cheese aerial is

mounted directly over a case containing the transmitter, receiver and power supply. Power supply is from a motor generator giving a.c. at 500 c/s. The transmitter frequency is between 9 434 and 9 524 Mc/s; peak power is 30 kW, pulse duration 0.2 μs, and repetition frequency 1 000 per sec. All supervisory controls are placed near the display unit, which has a 9-inch c.r. tube with magnetic deflector coils rotated by servo motors coupled to the aerial scanner drive. Range scales give maxima of 5, 9 and 27 miles.

621.396.933.2 **1080**

Considerations in the Design of a Universal Beacon System.—L. B. Hallman, Jr. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1948, Vol. 36, No. 12, pp. 1526–1529.) Specifications are given for a beacon to be installed in aircraft for radar range extension, for transmission of air traffic control information (including range, azimuth, altitude and identity data) and for automatic transmission of intelligence required in the operation of the system. The beacon must operate whatever the operating frequency of the primary radar. Display systems for identity interrogation are outlined. Suitable arrangements of component units are illustrated by block diagrams.

621.396.933.23 **1081**

Indication of Landing Courses Independent of Weather Conditions.—K. F. Niessen. (*Philips Res. Rep.*, April 1948, Vol. 3, No. 2, pp. 130–139.) Continuation of 102 of January.

629.135.052 : 621.317.733 **1082**

Double-Ratio Bridges.—(*See* 1126.)

621.396.93 **1083**

Radar Aids to Navigation. [Book Review]—J. S. Hall (Ed.). McGraw-Hill, New York and London, 1947, 389 pp., 30s. (*Nature, Lond.*, 23rd Oct. 1948, Vol. 162, No. 4121, pp. 633–634.) Vol. 2 of the M.I.T. Radiation Laboratory series. " . . . describes the advantages and limitations of radar technique when applied to the problems of navigation and pilotage, whether the equipment is airborne, shipborne or ground-based."

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788 **1084**

On the Limits of Use of Thermal Manometers for the Measurement of Low Pressures.—L. Dunoyer. (*C. R. Acad. Sci., Paris*, 29th Nov. 1948, Vol. 227, No. 22, pp. 1147–1149.) A symmetrical bridge device is described which is sensitive to pressure variations of the order of 3×10^{-5} mm Hg.

538.221 : 621.318.323.2 **1085**

Ferrite H.F. Magnet Cores.—A. Weis. (*Funk u. Ton*, Nov. 1948, Vol. 2, No. 11, pp. 564–578.) The influence of the conductivity of ferromagnetic materials on their usefulness in circuit components is considered and the properties of semiconductor metal compounds, particularly the ferrites consisting of a divalent metal oxide with Fe_2O_3, are discussed. The results of investigations by the Hescho company on ferrites containing various proportions of Mn_3O_4 and Fe_2O_3 show that such materials have decided advantages, the loss angle being only a fraction of that of iron-dust cores of comparable permeability and the density little more than half the dust-core value. Ferrites can also be moulded easily into forms such as long thin cylinders, whose high permeability and low loss can be used with advantage in h.f. permeability tuning. Other applications are suggested and the Philips Mn/Zn and Ni/Zn ferrites, known as ferroxcube, are briefly mentioned.

546.28 **1086**

Temperature- and Humidity-Constant Organic Compounds of Silicon and their Suitability for Use in Electrotechnics.—W. M. H. Schulze. (*Funk u. Ton*, Dec. 1948, Vol. 2, No. 12, pp. 622–632.) Discussion of the electrical and mechanical properties of various materials, including silicones.

546.431.82 : 537.228.1 : 621.395.61/.62 **1087**

New Synthetic Piezoelectric Material.—G. N. Howatt, J. W. Crownover & A. Drametz. (*Electronics*, Dec. 1948, Vol. 21, No. 12, pp. 97–99.) Pure $BaTiO_3$ ceramic can acquire and retain induced piezoelectric properties if a d.c. polarizing field is applied. The properties and production of such material, and its use in a transducer, are discussed. See also 935 above.

546.431.82 : 537.228.2 **1088**

Electrostrictive Effect in Barium Titanate Ceramics.—W. P. Mason. (*Phys. Rev.*, 1st Nov. 1948, Vol. 74, No. 9, pp. 1134–1147.) When a d.c. bias is applied to a multicrystalline $BaTiO_3$ ceramic, an a.c. voltage can excite resonances in 4 different modes in the ceramic. The amount of motion is greater than in magnetostrictive materials, and $BaTiO_3$ may be an important electromechanical transducing element. All the modes can be explained on the assumption that when a given domain becomes ferroelectric, it loses its cubic structure and becomes tetragonal.

546.431.82 : 621.315.612 **1089**

Domain Structure of $BaTiO_3$ Crystals.—H. Blattner, W. Känzig, W. Merz & H. Sutter. (*Helv. phys. Acta*, 10th Aug. 1948, Vol. 21, Nos. 3/4, pp. 207–209. In German.) Summary of Swiss Phys. Soc. paper.

546.431.82 : 621.315.612 **1090**

Anomalies of the Specific Heat of $BaTiO_3$.—H. Blattner & W. Merz. (*Helv. phys. Acta*, 10th Aug. 1948, Vol. 21, Nos. 3/4, pp. 210–212. In German.) Summary of Swiss Phys. Soc. paper.

546.431.82 : 621.315.612 **1091**

Electrical Conductivity and Refractive Index of $BaTiO_3$.—G. Busch, H. Flury & W. Merz. (*Helv. phys. Acta*, 10th Aug. 1948, Vol. 21, Nos. 3/4, pp. 212–215. In German.) Summary of Swiss Phys. Soc. paper.

546.431.82 : 621.315.612.011.5 **1092**

Dielectric Properties of Titanates at Ultra-High Frequencies.—J. G. Powles. (*Nature, Lond.*, 16th Oct. 1948, Vol. 162, No. 4120, p. 614.) Curves are given for $BaTiO_3$ for frequencies of 1.5 Mc/s and 9 450 Mc/s and temperatures from 20° to 170°C. Complex-permeability data for the same two frequencies and a temperature of 21°C are tabulated for the titanates of Mg, Ca and Sr, and also for $BaTiO_3$ at 24 000 Mc/s.

546.431.82 : 621.315.612.011.5 **1093**

Dielectric Properties of Mixed Barium and Strontium Titanates at 10 000 Mc/s.—J. G. Powles. (*Nature, Lond.*, 23rd Oct. 1948, Vol. 162, No. 4121, p. 655.) Complex permittivity as a function of the percentage of $BaTiO_3$ is shown graphically.

620.197 **1094**

Protective Finishing of Electrical Equipment.—F. Widnall & R. Newbound. (*J. Instn elect. Engrs*, Part II, Dec. 1948, Vol. 95, No. 48, pp. 695–702.) Discussion on 1057 of 1948.

621.3.032.53 : 533.5 : 666.1.037.5 **1095**

Glass-to-Metal Sealing.—In future the U.D.C. number 666.1.037.5 will be used for this subject, instead of 621.3.032.53 : 533.5 as formerly.

621.314.63 **1096**

Theory of Rectification of an Insulating Layer.—H. Y. Fan. (*Phys. Rev.*, 15th Nov. 1948, Vol. 74, No. 10, pp. 1505–1513.)

621.315.59 : 061.3 **1097**

Semiconductors and their Applications.—W. Grattidge & F. A. Vick. (*Nature, Lond.*, 16th Oct. 1948, Vol. 162, No. 4120, pp. 624–626.) Brief details of the papers read at a conference of the Manchester and District Branch of the Institute of Physics.

621.315.59 : 621.383 **1098**

Photoelectric Emission and Contact Potentials of Semiconductors.—L. Apker, E. Taft & J. Dickey. (*Phys. Rev.*, 15th Nov. 1948, Vol. 74, No. 10, pp. 1462–1474.) In spherical photocells with interchangeable emitters, energy distributions of external photoelectrons from the semiconductors Te, Ge and B were compared with those of several metals.

621.315.61 **1099**

Insulating Materials for U.S.W. Technics.—W. M. H. Schulze. (*Elektrotechnik, Berlin*, Oct. 1948, Vol. 2, No. 10, pp. 273–279.) Discussion, with numerous tables and diagrams, of the electrical characteristics of about 50 materials, including most of the new synthetic materials, at frequencies up to 10^{10} c/s and for a few materials up to 10^{12} c/s. The 38 references include 20 from German sources.

621.315.611.011.5 **1100**

Breakdown of Solid Insulating Materials.—P. Perlick. (*Arch. elekt. Übertragung*, April/May 1948, Vol. 2, Nos. 4/5, pp. 174–185.) Wagner's theory of thermal breakdown is satisfactory for problems in the thermal range; the dependence of the breakdown voltage on the ambient temperature and on the frequency can be estimated quantitatively from the material constants. The fundamentals of the principal theories of breakdown are reviewed and compared with experimental results. Breakdown in solids is also compared with breakdown in air or in oil. Breakdown with d.c. occurs in nearly every case at a voltage equal to or below the a.c. peak voltage. The a.c. breakdown voltages recently reported for h.v. cables, which were low in comparison with the d.c. breakdown voltages, are not in agreement with measurements on thin samples and can only be attributed to internal or external edge effects.

621.318.22 **1101**

New Magnetic Alloy.—"Diallist". (*Wireless World*, Jan. 1949, Vol. 55, No. 1, p. 38.) A Ni-Al-Co-Fe alloy containing a minute percentage of Nb has higher coercivity than that of any known alloy. It has been developed by the Permanent-Magnet Association in collaboration with the Electrical Research Association.

621.383.4 **1102**

New Photoconductive Cells.—E. Schwarz. (*Nature, Lond.*, 16th Oct. 1948, Vol. 162, No. 4120, pp. 614–615.) Various methods in which an electric discharge is active can be used to produce such cells from a number of substances which form two groups. The first group (which includes Pt, Ni, Sb and Ge) has the properties that if the carrier is kept at or below room temperature during the production, the film has a high resistance, a high negative temperature coefficient of resistance (β) and has its optimum sensitivity in the near infra-red. Heating the film in air or oxygen afterwards reduces the sensitivity, the resistance and β. The substances in the second group (which includes the sulphides, selenides and tellurides of Pb, Sn, In, Tl, Cd, Bi and Sb) have similar properties before heating. Heat treatment in air or oxygen at a low temperature temporarily reduces the sensitivity, the resistance and β, but prolonged heat treatment at a higher temperature increases these quantities again. Most of the tellurides show high sensitivity only at − 78°C or at the temperature of liquid air. Some of the sulphides are very sensitive even at room temperature.

666.1.037.5 : 669.018.47 : 536.413.2 **1103**

The Effect of the Melting Point and the Volume Magnetostriction on the Thermal Expansion of Alloys.—J. J. Went. (*Philips tech. Rev.*, Sept. 1948, Vol. 10, No. 3, pp. 87–94.) The thermal expansion coefficient for an alloy can be determined in terms of the melting points and magnetostrictive properties of the constituent metals. This is used to determine, for example, an alloy of Fe, Ni, Co and Cu which can be sealed to hard glass.

669.14-15 : 621.365.5 **1104**

Surface Treatment of Steel by means of H.F. Induction Heating.—Kegel. (*See* 1143.)

533.583 : 621.385 **1105**

Production and Use of Getter Materials in German Radio Valves, Thermionic Devices generally, and Electric Lamps. [Book Notice]—B.I.O.S. Final Report No. 1834, H.M. Stationery Office, London, 29 pp., 4s. General information is arranged according to the firm supplying it, but detailed information according to the type of volatile or non-volatile getter used.

MATHEMATICS

51 : 621.396 **1106**

Mathematics and Radio Problems.—B. van der Pol. (*Philips Res. Rep.*, June 1948, Vol. 3, No. 3, pp. 174–190.) The author discusses the lack of mutual understanding between technicians, physicists and mathematicians. Other topics dealt with are: the relation between Dirac's delta function and Stieltjes integrals; Hurwitz's determinants characterizing the stability of linear systems; wave equation; diffraction around a sphere (propagation of radio waves); continued fractions applied to filter circuits; nonlinear differential equations as related to valve oscillators; modern electrical calculating machines.

518.5 **1107**

A Digital Computer for Scientific Applications.—C. F. West & J. E. DeTurk. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1948, Vol. 36, No. 12, pp. 1452–1460.) The machine consists of a central control, an arithmetic unit, and two memory devices; the electronic techniques used are briefly described. The high-speed Hg-pool memory has a capacity of 4 080 words, each of 45 binary digits. A magnetic tape is used as a permanent storage medium and has a capacity of 200 000 words.

518.5 **1108**

On a Principle of Connexion for Bush Integrators.—O. Amble. (*J. sci. Instrum.*, Dec. 1946, Vol. 23, No. 12, pp. 284–287.) A Bush integrator is a precision means of interconnecting three shafts so that their rotations u, v, w satisfy the equation $w = \int v\, du$. A regenerative connection is one for which the output rotation w contributes to the input rotation u. By means of such connections, a logarithm or square root can be generated with one integrator, and any rational power with two. See also 1109 below.

518.5 **1109**

Extensions in Differential Analyser Technique.—J. G. L. Michel. (*J. sci. Instrum.*, Oct. 1948, Vol. 25, No. 10, pp. 357–361.) Analysis and extension of Amble's work (1108 above). Examples are also given of (*a*) the generation of the integral of a quotient, (*b*) the solution of differential equations in which the highest-order derivative has a variable coefficient, and (*c*) the inversion of functions defined by a differential equation.

518.5 : 621.385.832 **1110**

An Electronic Memory.—(*Elect. Times*, 11th Nov. 1948, Vol. 114, No. 2975, p. 575.) Brief summary and discussion of I.E.E. paper entitled "A Storage System for use with Binary-Digital Computing Machines", by F. C. Williams & T. Kilburn. A great deal of information can be stored on the face of a c.r. tube in the form of electrical charges, using a scanning system similar to that of a television raster and interrupting the beam to give charged areas. The charges so deposited are detected by means of a metal-foil covering on the face of the tube.

MEASUREMENTS AND TEST GEAR

531.761 : 621.385.832 : 539.16.08 **1111**

A Cathode-Ray Tube Chronoscope.—D. Pitman. (*Electronic Engng*, Dec. 1948, Vol. 20, No. 250, pp. 384–389.) A crystal-controlled oscillator drives two frequency-divider units which both have 'staircase' waveform. Each input pulse from the oscillator charges a capacitor until a predetermined potential is reached, when the capacitor is discharged and the cycle repeats. The input signal is made to create a phase difference between the waves in the two units, which is proportional to the duration of the signal and can be displayed on a c.r.o. For direct reading, the oscillator frequency must be 10^n c/s, where n is an integer, and the frequency-divider units must divide by 10. In the present design, $n = 5$ and intervals between 10 μs and 0.1 sec can be measured to within ± 10 μs. By means of additional circuits the system can be adapted for counting. Circuit and operation details are discussed and various applications are suggested.

531.764.5 : 621.396.615.18 **1112**

An Experimental Piezoelectric Chronometer employing Regenerative Frequency Division.—A. R. Jarvis, E. Cowcher, R. Keith & J. A. Poll. (*A.W.A. tech. Rev.*, Oct. 1948, Vol. 8, No. 1, pp. 49–67.) Outputs of 100 kc/s, 10 kc/s, 1 kc/s, 250 c/s and 50 c/s are available from a 100-kc/s crystal oscillator. The amplified 50-c/s output will drive synchronous clocks with an accuracy better than ± 1 sec per week. The design of suitable frequency dividers is discussed.

531.764.5 : 621.396.615.18 **1113**

A Compact Piezoelectric Chronometer.—J. E. Benson & E. M. Dash. (*A.W.A. tech. Rev.*, Oct. 1948, Vol. 8, No. 1, pp. 69–75.) A frequency generator for operating standard 50-c/s clocks from a precision 100-kc/s quartz crystal. Two decade regenerative divider stages are used for frequency division to 1 kc/s, followed by two counter-type stages. The equipment is built on standard carrier panels and occupies about 2 ft 8 in. of rack space.

621.3.018.4(083.74) **1114**

A Microwave Secondary Frequency Standard.—R. R. Unterberger & W. V. Smith. (*Rev. sci. Instrum.*, Sept. 1948, Vol. 19, No. 9, pp. 580–585.) A 10-Mc/s crystal oscillator, a f.m. klystron oscillator and crystal mixers are used to supply frequency markers at 90-Mc/s intervals from 2 970 Mc/s to above 40 000 Mc/s. Interpolation between markers is possible by means of a calibrated receiver. The equipment may be used for measuring spectra or for calibrating wavemeters. Absorption lines providing reference frequencies between 23 000 and 40 000 Mc/s are tabulated.

621.3.092 **1115**

Phase and Group Velocities and their Measurement.—W. Deutschmann. (*Funk u. Ton*, Dec. 1948, Vol. 2, No. 12, pp. 607–621.) Discussion of the application of these two concepts in the theory of the propagation of signals through networks. In certain cases neither these concepts nor the 'frequency velocity' defined by Bürck & Lichte (*Elekt. Nachr. Tech.*, March 1938, Vol. 15, No. 3, pp. 78–101) suffice to characterize the propagation completely. Methods of measurement are described and their advantages and disadvantages mentioned.

621.317.2 **1116**

Laboratory Antenna Distribution System.—F. Mural. (*Proc. Radio Cl. Amer.*, 1948, Vol. 25, No. 1, pp. 3–12.) A system designed to provide for 8 television channels. 7 are those assigned to the New York City area and the 8th is available for a signal generated in the laboratory. Each of the signals is distributed to 10 test positions in the laboratory.

621.317.3 : 621.385.001.4 **1117**

Quality Control for Receiving Valves, and Industrial Applications.—R. Suart. (*Radio franç.*, Oct. 1948, pp. 6–10.) Routine methods are described for the measurement of all electrical constants, background noise and microphony, and also for testing physical characteristics, in order to ensure a uniformly good quality in mass production.

621.317.324† : 621.396.93 **1118**

Field-Strength Estimation by Means of High-Frequency Direction-Finders in H.M. Ships.—C. Crampton & H. S. Toczylowski. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 809–814.) The measurement of the field strength of signals received on two types of h.f. direction finder and the application of the results to the estimation of the range of transmitters of known characteristics are described. The accuracy of the method and its useful range are given, together with details of experimental checks.

621.317.33 : 621.315.59 **1119**

On the Determination of the Electromagnetic Constants of Semiconductors at U.H.F.—P. Jacottet. (*Helv. phys. Acta*, 10th Aug. 1948, Vol. 21, Nos. 3/4, pp. 251–260. In German.) Formulae are given for obtaining the dielectric constant, loss angle and reflection factor from measurements with a cylindrical resonator. The method is similar to that of Féjer & Scherrer (1176 of 1943). Results are given for a buna type of material.

621.317.336.029.64 **1120**

A Swept-Frequency 3-Centimeter Impedance Indicator.—H. J. Riblet. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1948, Vol. 36, No. 12, pp. 1493–1499.) The magnitude and phase of an impedance over a 12% variation of frequency can be deduced from the display produced on a c.r. tube by the equipment. Method, operation and performance are discussed.

621.317.372 **1121**

"Q" Meters.—H. G. M. Spratt. (*Wireless World*, Jan. 1949, Vol. 55, No. 1, pp. 7–10.) Description, with complete circuit details, of a Dawe Instruments meter, and of its use for measurements on capacitors, resistors and transmission lines.

621.317.374 : 631.316.8 **1122**

A Method for Measuring the Loss Angle of Resistors.—J. Heffels. (*Arch. elekt. Übertragung*, Feb./March 1948, Vol. 2, Nos. 2/3, pp. 78–83.) A bridge method making use of a standard resistor of low loss.

621.317.71 : 621.385.3 **1123**

Fluctuations in Electrometer Triode Circuits.—A. van der Ziel. (*Physica, 's Grav.*, Feb. 1942, Vol. 9, No. 2, pp. 177–192. In English.) Only the Brownian movement in the triode input circuit and the shot-effect of the grid d.c. produce any marked effect on the accuracy of small-current measurement with electrometer valves. The r.m.s. errors are calculated for three different methods of measurement. When the input resistance is of the order of $10^{14}\ \Omega$, the r.m.s. error is only about 2×10^{-18} A.

621.317.715 : 621.396.645.371 **1124**

Influence of Reactive Feedback Networks on the Response of Galvanometers.—Savic. (*See* 1014.)

621.317.729 **1125**

Automatic Plotting of Electrostatic Fields.—P. E. Green, Jr. (*Rev. sci. Instrum.*, Oct. 1948, Vol. 19, No. 10, pp. 646–653.) The usual electrolyte-tank method has been extended by adding a servomechanism which causes the probe to trace out an equipotential automatically.

621.317.733 : 629.135.052 **1126**

Double-Ratio Bridges.—(*Elect. Times*, 20th Jan. 1949, Vol. 115, No. 2985, pp. 73–74.) Brief summaries of two I.E.E. papers: "Double-Ratio A.C. Bridges with Inductively Coupled Ratio Arms", by H. A. M. Clark & P. B. Vanderlyn, and "Direct-Capacitance Aircraft Altimeter", by W. L. Watton & M. E. Pemberton. The bridge discussed in the first paper was used in the altimeter described in the second; the altimeter was not suitable for heights above 200 ft.

621.317.74 : 621.315.2 **1127**

Two Test Sets for the Maintenance of Carrier-Current Systems on Balanced-Pair or Coaxial Cables.—P. Herreng. (*Câbles & Transmission, Paris*, Oct. 1948, Vol. 2, No. 4, pp. 305–318. With English summary.) Apparatus for measuring transmission constants and absolute voltage levels over a wide range of frequencies, and also the nonlinear distortion of repeaters.

621.317.755 **1128**

A Frequency Characteristic Analyzer.—J. W. Sampsell. (*Rev. sci. Instrum.*, Oct. 1948, Vol. 19, No. 10, pp. 620–627.) For analysing the frequency characteristics of filters, amplifiers etc., whose pass bands are within the range 500 c/s–50 kc/s. Special features are: (*a*) the width of the swept band and the rate of sweep can be varied independently, (*b*) the frequency is swept linearly, (*c*) the response of the pass-band circuit can be made to appear at any point in the sweep, and (*d*) the c.r.o. timebase can be interlocked with the generator frequency.

621.317.761 **1129**

A Direct-Reading Frequency-Measuring Set.—F. C. F. Phillips. (*Proc. Instn Radio Engrs, Aust.*, Jan. 1948, Vol. 9, No. 1, pp. 12–19.) Reprint of 156 of January.

621.317.763.029.63 : 621.396.611.4 **1130**

The Design and Use of Resonant Cavity Wavemeters for Spectrum Measurements of Pulsed Transmitters at Wavelengths near 10 cm.—H. R. Allan & C. D. Curling. (*J. Instn elect. Engrs*, Part III, Nov. 1948, Vol. 95, No. 38, pp. 473–484.) The factors influencing the design of cylindrical resonators for frequencies near 3000 Mc/s are discussed. The H_{011} mode is used and it is shown how the dimensions for optimum Q and freedom from unwanted resonances are obtained. Tuning is effected by the use of a coaxial plunger whose diameter is about $\frac{1}{5}$ of that of the resonator; an almost linear frequency variation with plunger position is obtained over a considerable range. Transmitter spectra are checked by observing the changes in output of a diode detector, coupled to the cavity, as the tuning of the cavity is varied. Errors arising in the method of coupling, and in the behaviour of the cavity itself, are examined.

621.317.763.029.65† : 535.33.071 **1131**

A Grating Spectrometer for Millimeter Waves.—R. J. Coates. (*Rev. sci. Instrum.*, Sept. 1948, Vol. 19, No. 9, pp. 586–590.) A paraboloid of revolution, with a double waveguide feed at the focus, is used for illuminating a reflecting echelette grating and receiving the reflected signal. The grating angles corresponding to the intensity peaks can be read within ± 0.04% for λ 3–12.5 mm. Observed and theoretical intensity curves are compared.

621.317.79 : 621.396.611.1 **1132**

An Instrument for Measuring the Resonant Frequency of Reradiating Structures.—W. Struszynski, E. G. Robus & J. C. Woolley. (*J. Instn elect. Engrs*, Part IIIA, 1947, Vol. 94, No. 15, pp. 741–750.) The instrument consists of an oscillator whose output coil is inductively coupled to the structure, and an amplifying detector with a screened-loop pickup coil for measuring the induced current, which shows marked increases at the resonant frequencies of the structure. The circuit theory is analysed and various applications are illustrated.

621.397.62.001.4 **1133**

Television Crosshatch Generator.—(*Electronics*, Jan. 1949, Vol. 22, No. 1, pp. 154..158.) An instrument requiring little power, which can be connected directly to a television receiver to produce on the receiver screen a test pattern of intersecting vertical and horizontal lines. A circuit diagram is given.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

535.61-15 **1134**

Present State of Knowledge and Technical Applications of Infra-Red Radiation.—K. Grosskurth. (*Fernmeldetech. Z.*, Oct. 1948, Vol. 1, No. 7, pp. 169–174.) A general review, with tables and graphs showing the properties of various types of photocells. A description is included of the electron-optical image converter developed in Germany and used in many war-time applications.

539.16.08 **1135**

Reduction of Dead Times in Geiger-Müller Counters.—B. Collinge. (*Nature, Lond.*, 27th Nov. 1948, Vol. 162, No. 4126, pp. 853–854.)

539.16.08 **1136**

The Geiger Discharge.—D. H. Wilkinson. (*Phys. Rev.*, 15th Nov. 1948, Vol. 74, No. 10, pp. 1417–1429.) The mechanism of formation of the space-charge sheath is analysed, and the theory is used to calculate (*a*) the relation between starting potential and counter variables, (*b*) the amount of charge generated, (*c*) the shape of the plateau curve, (*d*) the velocity of propagation along the wire. All forms of counter behaviour are shown to depend strongly on the ratio of charge generated in the counter to that originally on the wire.

539.16.08 **1137**

The Mechanism of the Geiger-Müller Counter.—A. Nawijn. (*Physica, 's Grav.*, May 1942, Vol. 9, No. 5, pp. 481–493. In English.)

539.16.08 **1138**

On some Fluctuation Problems connected with the Counting of Impulses produced by a Geiger-Müller Counter or Ionization Chamber.—H. A. van der Velden & P. M. Endt. (*Physica, 's Grav.*, July 1942, Vol. 9, No. 7, pp. 641–657. In English.)

539.16.08 **1139**

Measurements on Self-Quenching Geiger-Müller Counters.—A. G. M. van Gemert, H. den Hartog & F. A. Muller. (*Physica, 's Grav.*, June & July 1942, Vol. 9, Nos. 6 & 7, pp. 556–564 & 658–664. In English.)

539.16.08 **1140**

Origin of the Temperature Effect in Alcohol-Argon-Filled Geiger-Müller Tubes.—G. Joyet & M. Simon. (*Helv. phys. Acta*, 10th Aug. 1948, Vol. 21, Nos. 3/4, pp. 180–183. In French.) Summary of Swiss Phys. Soc. paper.

539.16.08 : 531.761 : 621.385.832 **1141**

A Cathode-Ray Tube Chronoscope.—Pitman. (*See* 1111.)

621.316.726 : 615.84 **1142**

Frequency Stabilization of Diathermy Units.—C. K. Gieringer. (*Electronics*, Dec. 1948, Vol. 21, No. 12, pp. 78–80.) Discussion of the problems involved in maintaining the frequency of diathermy units within F.C.C. limits, and description of a plug-in monitor which stops the oscillator and sounds a buzzer when the frequency drift exceeds a predetermined amount.

621.365.5 : 669.14-15 **1143**

Surface Treatment of Steel by means of H.F. Induction Heating.—K. Kegel. (*Elektrotechnik, Berlin*, Oct. 1948, Vol. 2, No. 10, pp. 285–291.) The advantages of the method are enumerated and suitable equipment is described, including a 30-kW h.f. generator; practical examples include the hardening of (*a*) parts of complex shape, and (*b*) the teeth of gear wheels.

621.38.001.8 **1144**

Design for a Brain.—W. R. Ashby. (*Electronic Engng*, Dec. 1948, Vol. 20, No. 250, pp. 379–383.) Discussion of the Homeostat, a machine incorporating negative feedback which is claimed to be capable of automatically seeking the optimum adjustment of its controls to meet any change in operating conditions.

621.38.001.8 : 061.3 **1145**

Electronics in Industry.—(*Electrician*, 26th Nov. 1948, Vol. 141, No. 3676, pp. 1593–1594.) Brief details of papers read at the first Electronics Symposium organized by the Scientific Instrument Manufacturers' Association.

621.38.001.8 : 539.17 **1146**

Electronics in Nuclear Physics.—W. E. Shoupp. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1948, Vol. 36, No. 12, pp. 1518–1526.)

621.383 : 535.61-15 **1147**

The Image Converter.—H. Mahl. (*Elektron Wiss. Tech.*, Nov. 1948, Vol. 2, No. 11, pp. 260–268.) Basic principles are outlined. Various early types are shown and diode and triode arrangements are described which use electron-optical immersion objectives. Applications are illustrated.

621.384.6 **1148**

A Travelling-Wave Linear Accelerator for 4-MeV Electrons.—D. W. Fry, R. B. R. S. Harvie, L. B. Mullett & W. Walkinshaw. (*Nature, Lond.*, 27th Nov. 1948, Vol. 162, No. 4126, pp. 859–861.) Basic principles and a first model of such an accelerator were discussed in 506 of 1948. The length of the accelerator here described is 2 m and the r.f. power is 2 MW.

621.384.6 **1149**

Air-Cored Synchrotron.—T. R. Kaiser & J. L. Tuck. (*Nature, Lond.*, 16th Oct. 1948, Vol. 162, No. 4120, pp. 616–618.) Discussion of a method of accelerating electrons to extreme relativistic energies which may be specially applicable to this type of synchrotron. See also 1350 and 1432 of 1948 (Blewett).

621.384.6 **1150**

Electrostatic Deflection of a Betatron or Synchrotron Beam.—E. D. Courant & H. A. Bethe. (*Rev. sci. Instrum.*, Oct. 1948, Vol. 19, No. 10, pp. 632–637.)

621.384.6 **1151**

Research on the Electron Cyclotron.—H. Salow. (*Funk u. Ton*, Oct. 1948, Vol. 2, No. 10, pp. 531–538.) Description of equipment and discussion of results for electron paths in resonance and out of resonance. The effects of varying operational parameters are also considered.

621.385.15 **1152**

The Determination of the Pulse Period of Electron Multiplier Tubes.—G. Papp. (*Rev. sci. Instrum.*, Sept. 1948, Vol. 19, No. 9, pp. 568–569.)

621.39 : 578.088.7 **1153**

An Ink-Writing Cardiochronograph for the Study of the Activity of the Human Autonomic Nervous System.—W. W. Loucks, S. S. Kostashuk & A. C. Burton. (*Canad. J. Res.*, Oct. 1948, Sec. F, Vol. 26, No. 10, pp. 447–456.)

621.396.645.001.8 : 535.6 **1154**

Applications of Alternating Current Amplifiers to Optical Measurements.—Harris. (*See* 1007.)

621.396.9 : 623.26 **1155**

Development and Use of Magnetic Apparatus for Bomb and Mine Location.—A. Butterworth. (*J. Instn elect. Engrs*, Part II, Dec. 1948, Vol. 95, No. 48, pp. 645–652. Discussion, pp. 664–667. Summary, *ibid.*, Part I, Sept. 1948, Vol. 95, No. 93, p. 407.) Full paper; summary noted in 2882 of 1948.

621.396.9 : 623.26 **1156**

Development of Locators of Small Metallic Bodies buried in the Ground.—B. Roston. (*J. Instn elect. Engrs*, Part II, Dec. 1948, Vol. 95, No. 48, pp. 653–664. Discussion, pp. 664–667. Summary, *ibid.*, Part I, Sept. 1948, Vol. 95, No. 93, p. 408.) Full paper: summary noted in 2882 of 1948.

PROPAGATION OF WAVES

538.566 + 621.396.812.029.64 **1157**

Phase Difference between the Fields of Two Vertically Spaced Antennas.—E. W. Hamlin & A. W. Straiton. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1948, Vol. 36, No. 12, pp. 1538–1543.) The phase difference is considered as a function of transmitter and receiver heights, and of range, for line-of-sight microwave propagation. The results obtained have helped to interpret experimental results such as those noted in 1182 of 1947 (Sharpless), 3225 of 1948 (Straiton & Gerhardt) and 493 of February (Hamlin & Gordon).

538.566 : 534.222.1 : 621.392.26† **1158**

On the Theory of Spherically Symmetric Inhomogeneous Wave Guides, in connection with Tropospheric Radio Propagation and Under-Water Acoustic Propagation.—H. Bremmer. (*Philips Res. Rep.*, April 1948, Vol. 3, No. 2, pp. 102–120.) The atmosphere is regarded as an inhomogeneous medium forming a curved waveguide through which radio and sound waves can be propagated. Such propagation is in many respects similar to that of underwater sound waves, but essential differences are pointed out. These differences are due to the fact that the product of distance from the centre of the earth and index of refraction has at least one minimum for atmospheric propagation and one maximum for oceanic propagation. In consequence, the interval between the arrival of consecutive rays originating from a point source is, for atmospheric propagation, least for the rays coming latest, while for oceanic propagation it is least for those coming earliest. Arbitrary spherically symmetrical waveguides are discussed, and the concept of cut-off frequency is considered from the point of view of the modes as well as from that of geometrical optics.

538.566 : 551.5 **1159**

Some Problems in Radio Meteorology.—H. G. Booker. (*Quart. J. R. met. Soc.*, July/Oct. 1948, Vol. 74, Nos. 321/322, pp. 277–315.) Discussion of atmospheric refraction of radio waves. Results obtained at war-time radar stations and the general nature of superrefraction are considered; see also 516 of 1947. Propagation curves were given in 2892 of 1947 (Booker & Walkinshaw) for calculating the field strength due to a given transmitter under specified conditions of superrefraction; the problem here considered is the determination of these conditions of superrefraction from the ordinary data available in synoptic meteorology. The conjugate power-law theory of eddy-diffusion is tentatively used for study of the profiles of temperature and humidity involved in certain types of superrefraction; theoretical and observed profiles are compared. The limitations of the theory and possible methods of overcoming them are considered. See also 3487 of 1948 (Macfarlane).

621.396.11 **1160**

Work of Soviet Scientists in the Field of Propagation of Ultra-Short Radio Waves.—B. A. Vvedenski. (*Bull. Acad. Sci. U.R.S.S. tech. Sci.*, June 1948, No. 6, pp. 835–852. Bibliography, pp. 852–854. In Russian.) A brief survey of investigations carried out by Soviet scientists during the last 25 years at m, dm and cm wavelengths.

621.396.11 **1161**

Range of Low-Power Radiocommunication.—M. V. Callendar. (*J. Instn elect. Engrs*, Part III, Nov. 1948, Vol. 95, No. 38, pp. 425–435; summary, *ibid.*, Part I, Nov. 1948, Vol. 95, No. 95, p. 506.) Data available for calculating the ground-ray field strength are summarized and simplified field-strength formulae derived. Power losses at the transmitting aerial and the field strength required to overcome noise at the receiver are considered in typical cases. Maximum-range curves are deduced for a 1-W transmitter and wavelengths from 0.5 to 2 000 m, with aerials at heights up to 15 000 ft.

621.396.11 : 535.312 **1162**

Reflections from Flat Sheet and Angle Reflectors.—L. Lewin. (*J. Instn elect. Engrs*, Part III, Nov. 1948, Vol. 95, No. 38, pp. 485–488.) "The reflection diagram from a flat sheet is the same as the transmission polar diagram of an aperture of double the dimensions of the sheet. A small deviation from flatness considerably alters the diagram, a sag of half a wavelength at the centre producing a zero where there would otherwise have been a maximum. The right-angled corner reflector is also investigated, and the broad reflection diagram expected from geometrical optics is found. The effect of a small departure of the included angle from a right angle is also discussed."

621.396.11 : 551.510.535 **1163**

The Variation of the Height of the F-Layer, Cause of the Changes of the Frequency of Radio Waves during Propagation.—K. Rawer. (*C. R. Acad. Sci., Paris*, 29th Nov. 1948, Vol. 227, No. 22, pp. 1149–1151.) Systematic measurements of the angle of arrival of the WWV transmissions show that the angle decreases as the frequency increases. The results correspond to a 5-hop path for the 5-Mc/s signals, with 4 and 2 hops respectively for the 10-Mc/s and 20-Mc/s signals. Calculations based on the daily variation of the height of the F layer give a frequency variation, for a path with 5 reflections, of the order of 20×10^{-8}. This is in good agreement with the measurements of Decaux (1725 of 1948). The changes of F-layer height at sunrise and sunset correspond also to the sign of the observed frequency changes.

621.396.11 : 551.510.535 **1164**

Distribution of the Field reflected by the Ionosphere in the Absence of Absorption.—P. Lejay & D. Lepechinsky. (*C. R. Acad. Sci., Paris*, 15th Nov. 1948, Vol. 227, No. 20, pp. 997–1000.) Methods are described for determining graphically the virtual trajectories of propagation (*a*) for plane earth and ionosphere, and (*b*) for curved earth and ionosphere. These methods are applied to find the field at a point distant from a transmitter, neglecting absorption. With a perfectly reflecting earth there is a considerable augmentation of the field at a given point, due to reflected radiation. At points near the limit of the skip zone considerable amplitude variations occur.

621.396.11 : 551.510.535 **1165**

On Attenuation Phenomena in the Ionosphere.—B. Beckmann. (*Arch. elekt. Übertragung*, April/May 1948, Vol. 2, Nos. 4/5, pp. 124–135.) A theoretical discussion, with an account of the principal results of echo and reception measurements carried out during 1943 and 1944 at the German Post Office Research Establishment, München. During the day, 'penetration attenuation' and D-layer attenuation are superposed, but after sunset only the former is found. Penetration attenuation varies approximately linearly with frequency. The variations of the maximum daytime attenuation are considerable; at the high and the low frequencies of the s.w. region the behaviour is fundamentally different, corresponding to the different origin of the attenuation at these frequencies. After sunset, when the D-layer attenuation disappears, the effects at the high and the low frequencies are similar. The seasonal variation of the attenuation is quite different for the high and the low frequencies. D-layer attenuation increases with the increased ionization from winter to summer and the penetration attenuation probably also increases in the summer. A decrease is, however, observed and is probably accounted for by a reduction of F-layer reflection due to an abnormal E layer. With transmission paths of the order of 1 000 km, for 25-m waves, only 25% of a large number of field-strength measurements showed the so-called sunset effect. In the majority of cases the field strength sank gradually below the sensitivity limit of the receiver. With oversea transmission paths sunset effects are not observed.

621.396.812 : 551.510.535 **1166**

Periodic or Rhythmic Variation of the Intensity of Short Wave Radio Signals.—S. S. Banerjee & R. N. Singh. (*Indian J. Phys.*, Sept. 1948, Vol. 22, No. 9, pp. 413–422.) Measurements of the angle of arrival of downcoming waves at sunrise and sunset show that periodic fading may be due to the reflection of waves from one or two ionospheric layers which have slow vertical movement and adequate electron density. Such movement is presumably caused by rapid changes of electron density during the transition periods of ionization. Slow periodic fading can also occur if the frequency used approaches the m.u.f. for the transmission path in question. In this case the interference is caused by magneto-ionic components of reflected waves, as suggested by Appleton & Beynon (2895 of 1947). Observations of periodic fading of s.w. signals transmitted from Delhi at various seasons and times of day are also discussed.

621.396.812.029.64 **1167**

Low-Level Atmospheric Ducts.—J. S. McPetrie & B. Starnecki. (*Nature, Lond.*, 20th Nov. 1948, Vol. 162, No. 4125, p. 818.) Correlation of meteorological data with microwave field-strength measurements at the ends of a 60-mile oversea path (see 518 of 1947) suggests as expected (see 516 of 1947) that high field strengths when the air is more than 5° warmer than the sea are due to ducts with a height of 80–120 ft, caused by a temperature inversion and/or a lapse in water vapour content near sea level. But when the air is more than 5° colder than the sea, ducts with a height of 20–50 ft are formed. This unexpected result may be due to the presence of sea spray whipped up by the wind.

RECEPTION

621.395.521.3 : 621.395.813 **1168**

Hysteresis Distortion of Pupin Coils.—H. Mermoz & M. Troublé. (*Câbles & Transmission, Paris*, Oct. 1948, Vol. 2, No. 4, pp. 319–346. With English summary.)

621.396.621 **1169**

F.M. Receiver Design Problems.—E. C. Freeland. (*Electronics*, Jan. 1949, Vol. 22, No. 1, pp. 104–110.) A survey of design and production techniques. The relative merits of limiter-discriminator, synchronized-oscillator and ratio detectors are discussed. Hum reduction and the tracing and elimination of regenerative effects in i.f. and r.f. stages are considered, particularly for a.c./d.c. receivers.

621.396.621 **1170**

F.M. and P.M. Demodulator.—J. A. Sargrove & R. E. Blaise. (*Electronics*, Jan. 1949, Vol. 22, No. 1, pp. 165 . . 171.) The newly developed phasitron circuit is described, in which a single multi-grid valve is used as a demodulator. Any conventional valve having two control grids is suitable. The incoming signal is applied to one grid; the other grid is connected to a high-Q circuit tuned to the mean carrier frequency. Because of the electron coupling between the two grids, oscillations are induced in the tuned circuit about 90° out of phase with the carrier oscillations. As the incoming signal deviates, because of its modulation, from the mean frequency, the oscillations in the tuned circuit vary in phase and thus the resultant anode current varies about its mean and the incoming f.m. signal is converted into an a.f. current. Various industrial applications are suggested.

621.396.621 : 621.396.619.13 **1171**

A Phase Discriminator for Frequency-Modulation Reception.—Newall & Spencer. (*See* 1001.)

621.396.621 : 621.396.9 **1172**

An Anti-Clutter Radar Receiver.—R. V. Alred & A. Reiss. (*J. Instn elect. Engrs*, Part III, Nov. 1948, Vol. 95, No. 38, pp. 459–465; summary, *ibid.*, Part I, Nov. 1948, Vol. 95, No. 95, pp. 507–508.) The loss of target echoes due to receiver saturation by responses from neighbouring land, rain storms, or sea can be much reduced by the use of a receiver in which the output is proportional to the logarithm of the input. The design and performance of such a receiver are described and other applications mentioned.

621.396.621.54 **1173**

The Tracking of Superheterodyne Receivers.—K. J. Coppin. (*J. Brit. Instn Radio Engrs*, Nov./Dec. 1948, Vol. 8, No. 6, p. 265–284.) The '2-point' method is shown to be generally unacceptable even when the two frequencies with zero tracking error are chosen as well as possible. Limitations of existing formulae for calculating oscillator circuit parameters for the commercially established '3-point' method are noted. The error form of this method is analysed and it is shown that, in general, within a tuning range, exact alignment may be obtained at three frequencies which are uniquely determined by the circuit constants. An expression is derived for calculating the tracking error at frequencies between these points. The three frequencies should be chosen so that, throughout the tuning range, maximum percentage tracking errors are numerically equal rather than maximum absolute errors. General equations for calculating oscillator circuit parameters are derived and a numerical example is included. Errors of the method are indicated.

621.396.621.54.029.6 **1174**

Developments in Radio-Receiver Circuits for the Ultra-Short-Wave Range.—A. van Weel. (*Philips Res. Rep.*, June 1948, Vol. 3, No. 3, pp. 191–212.) Frequency converters are described in which the signal voltage is applied in push-pull whereas the local-oscillator voltage is applied in parallel. The input circuit is tuned to both frequencies at the same time. Methods for blocking the local-oscillator power from the aerial are discussed. Designs for diode, triode, and self-oscillating mixers are considered in detail.

621.396.622 : 621.396.8 **1175**

Rectification of a Sinusoidally Modulated Carrier in the Presence of Noise.—D. Middleton. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1948, Vol. 36, No. 12, pp. 1467–1477.) The low-frequency output, signal and noise, is determined for an nth-power-law half-wave rectifier and for modulation up to 100%. Special attention is given to linear and square-law detectors, for which audio signal/noise ratios are calculated. The noise passed by the audio filter depends on the spectral shape of the i.f.; three types of filter are considered. The degree of modulation has little effect on output noise power if the mean input signal/noise power ratio $p>1$; for $p \to \infty$ the audio signal/noise ratio is proportional to the input carrier amplitude, is independent of the i.f. filter bandwidth and is only slightly dependent on filter shape.

621.396.8 **1176**

Signal-to-Noise Ratio in A.M. Receivers.—E. G. Fubini & D. C. Johnson. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1948, Vol. 36, No. 12, pp. 1461–1466.) Experiments confirm the theory of the effect of a linear detector on the signal and signal/noise ratio obtained by demodulation of a r.f. carrier. When a carrier is present, the output noise of a detector increases by 4 to 7 db, according to the shape of the i.f. filter. For sine-wave a.m. and i.f. bandwidths at least 3 or 4 times larger than the a.f. bandwidth, a universal curve can be given that shows the relation between the signal/noise ratio at the output and the carrier/noise ratio at the input of a second detector. If two a.m. carriers are simultaneously present at the input of a linear second detector, this discriminates against the modulation of the weaker carrier.

621.396.813 : 621.396.619.13 **1177**

The Necessary Bandwidth in Reception of F.M. Signals for Eliminating Nonlinear Distortion.—E. I. Manaev. (*Radiotekhnika, Moscow*, Sept./Oct. 1948, Vol. 3, No. 5, pp. 54–61. In Russian.) Approximate formulae (6) and (11), sufficiently accurate for practical purposes, are derived for determining the bandwidth of f.m. oscillations in the cases of sinusoidal and square-wave signals respectively. The components of the f.m. oscillations are assumed to be not smaller than 1% of the unmodulated carrier. The nonlinear distortion occurring in the tuned circuits of a receiver when the f.m. oscillations are being received is discussed. A formula (25) is derived for determining the coefficient of nonlinearity k_f which is equal to the ratio of the amplitude of the third harmonic of the frequency deviation to that of the first harmonic. Formula (30) is deduced for determining the necessary bandwidth of h.f. and i.f. amplifiers for a given k_f. Two numerical examples are included.

621.396.822 : 523.746 **1178**
Changes in Ionization and Radio Reception during the Sunspot-Period 1944-1947.—Stetson. (*See* 1035.)

621.397.828 **1179**
The Reduction of Interference in Television Sound Reception.—H. Fairhurst. (*J. Televis. Soc.*, Dec. 1947, Vol. 5, No. 4, pp. 126–131.) The effect on the sound channel is more serious than that on the picture. At 45 Mc/s the main sources of interference are the ignition systems of motor cars. The relative merits of different types of noise limiter are discussed. A series-diode-following circuit used in Murphy receivers is described, with full explanation of the reasons for choosing various component values.

STATIONS AND COMMUNICATION SYSTEMS

621.394.441 **1180**
Carrier-Frequency-Shift Telegraphy.—R. Ruddlesden, E. Forster & Z. Jelonek. (*J. Instn elect. Engrs*, Part III, Nov. 1948, Vol. 95, No. 38, pp. 454–458.) Discussion on 2354 of 1948.

621.396.1 **1181**
Geographical Distribution of the Frequencies Allocated by the Copenhagen Plan.—(*Radio tech. Dig., Édn franç.*, Dec. 1948, Vol. 2, No. 6, pp. 303–311.) See also 832 of March.

621.396.3 **1182**
Some Developments in Commercial Point-to-Point Radiotelegraphy.—J. A. Smale. (*J. Instn elect. Engrs*, Part III, Nov. 1948, Vol. 95, No. 38, pp. 454–458.) Discussion on 2358 of 1948.

621.396.5 **1183**
Modern Single-Sideband Equipment.—C. T. F. van der Wyck. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1948, Vol. 36, No. 12, p. 1505.) Comment on 3510 of 1948. The oscillator there discussed is included in U.S. patent No. 2 321 354 of 1943.

621.396.619.16 **1184**
Pulse Communication.—D. Cooke; Z. Jelonek & E. Fitch; A. J. Oxford. (*J. Instn elect. Engrs*, Part III, Nov. 1948, Vol. 95, No. 38, pp. 465–466.) Discussion on 2079 of 1948.

621.396.65.029.64 : 621.397.743 **1185**
6 000-Mc/s Television Relay System.—W. H. Forster. (*Electronics*, Jan. 1949, Vol. 22, No. 1, pp. 80–85.) A 2-way system operating between New York and Philadelphia. Repeaters and terminal equipment are described. See also 2921 of 1948.

621.396.712 **1186**
Planning the New KOMO Studios.—F. J. Brott & S. Bennett. (*Broadcast News*, Oct. 1948, No. 51, pp. 8–21.) An illustrated description of the general arrangement of studios, offices, etc. For further details see 1187–1189 and 1222 below.

621.396.712 **1187**
Constructing the KOMO Studios.—S. Bennett. (*Broadcast News*, Oct. 1948, No. 51, pp. 22–27.) Discussion of sound isolation, studio design and performance, reverberation measurements, etc. See also 1186 above.

621.396.712 **1188**
Equipment for the New KOMO Studios.—M. E. Gunn. (*Broadcast News*, Oct. 1948, No. 51, pp. 32–44.) An illustrated description, with block diagrams, of the master control room system, studio consoles, etc. See also 1186 above.

621.396.712 : 697 **1189**
Heating and Ventilating the New KOMO Studios.—J. K. Gannett. (*Broadcast News*, Oct. 1948, No. 51, pp. 28–31.) See also 1186 above.

621.396.712 (44) **1190**
The Allouis OCII Transmitting Centre for Broadcasting on Decametre Waves.—M. Matricon. (*Rev. tech. Comp. franç. Thomson-Houston*, Sept. 1948, No. 11, pp. 5–15. In French, with English summary.) For other accounts see 553 and 2922 of 1948; in the title of the letter OC III should read OC II.

621.396.931 **1191**
Some Australian Developments in F.M. Mobile Communication Equipments.—H. A. Ross: A. J. Campbell. (*A.W.A. tech. Rev.*, Oct. 1948, Vol. 8, No. 1, pp. 1–48.) Part 1, by Ross, discusses the design of experimental equipment on working frequencies of 43.2, 75.8 and 160.4 Mc/s, with special reference to discrimination against interference and fidelity of reproduction. Results of field tests on the 160.4-Mc/s equipment are given and a 3-dimensional contour map of the service area is discussed.

Part 2, by Campbell, outlines general considerations for the design of commercial equipment and some standard units are described and illustrated.

621.396.1 **1192**
International Radio Regulations. [Book Notice]—H.M. Stationery Office, London, 1947, 336 pp., 3s. 6d. (*Govt Publ., Lond.*, Nov. 1948, p. 13.) Contains the appendices and additional radio regulations annexed to the International Telecommunication Convention, Atlantic City, 1947. This edition is a photostat copy of the English text published by the Bureau of the International Telecommunications Union, Berne, omitting the facsimile signatures of the original.

SUBSIDIARY APPARATUS

621-526 + 621.316.7 **1193**
Servomechanisms and Regulators. Stability Criteria. Application Examples.—C. Galmiche. (*Rev. gén. Élect.*, Jan. 1949, Vol. 58, No. 1, pp. 19–30.) General stability criteria are applied in a detailed discussion of (*a*) speed regulation of d.c. motors by means of a Leonard combination with ‘rototrol’ excitation, (*b*) voltage regulation by electronic methods. The analogy between servomechanisms and electrical feedback devices is discussed in a short appendix.

621-526 : 621.3 **1194**
The Contribution of Electricity to the Technique of Servomechanisms.—G. Lehmann. (*Bull. Soc. franç. Élect.*, Oct. 1948, Vol. 8, No. 85, pp. 496–500.)

621.3.027.3 : 539.16.08 **1195**
High-Voltage Supplies for G-M Counters.—A. Thomas. (*Electronics*, Dec. 1948, Vol. 21, No. 12, pp. 100–103.)

621.316.722.4 : 621.396.645 **1196**
Low-Impedance Variable Voltage Tappings.—Scroggie. (*See* 1004.)

621.316.99 **1197**
The Design of Earthing Devices in Communication Equipment.—E. A. Alekhin. (*Vestnik Svyazi*, 1948, No. 11, pp. 12–13. In Russian.) Nomograms are given for earthing devices using pipes, wires or plates.

621.385.832 : 535.247 **1198**
A Recording Photometer and its Use in Studies of Cathode-Ray Screen Displays.—F. Hamburger, Jr, & E. J. King. (*J. opt. Soc. Amer.*, Oct. 1948, Vol. 38, No. 10, pp. 875–879.) A 931-A photo-multiplier tube is combined with suitable optical and electronic

auxiliaries in an instrument sensitive to either transient or slow brightness changes at any selected point of a c.r. screen.

621.396.68 **1199**

Very High Voltage Supply without H.V. Transformer.—M. Alixant. (*Radio tech. Dig., Édn franç.*, Oct. 1948, Vol. 2, No. 5, pp. 239–249.) A review of h.f. oscillator and pulse methods suitable for use in television receivers, and a short description of some practical circuits.

621.396.68 : 621.316.722 **1200**

Stabilized Power Supplies: Part 3 — Extension of Output Voltage Range.—M. G. Scroggie. (*Wireless World*, Dec. 1948, Vol. 54, No. 12, pp. 453–456.) A detailed circuit diagram is given and discussed, showing how output voltage can be varied between 0 and 500 V. See also 1004 above.

771.3 : 621.317.755 **1201**

A New, Versatile Camera for the Cathode-Ray Oscillograph.—H. P. Mansberg. (*Oscillographer*, Oct./Dec. 1948, Vol. 10, No. 4, pp. 2–14.) General description of the Du Mont Type 314 camera.

TELEVISION AND PHOTOTELEGRAPHY

621.397.2 **1202**

Electronics in the Service of the Press. The Transmission of Pictures to a Distance.—E. Belin. (*Radio tech. Dig., Édn franç.*, Oct. 1948, Vol. 2, No. 5, pp. 209–223.) Discussion of methods suitable for (*a*) telephony circuits, and (*b*) radio links, with examples of the results obtained.

621.397.26 **1203**

Ultrafax.—(*Electronics*, Jan. 1949, Vol. 22, No. 1, pp. 77–79.) The material to be transmitted is photographed on 35-mm film; high speed scanning of the image is achieved by using as light source a c.r. tube with a special low-persistence phosphor screen. By means of a multiplier photocell modulator, the message is made to modulate a 7 000-Mc/s carrier wave. Normal television technique is used for reception and the image on the c.r. tube is photographed on 16-mm film which can be developed in a few seconds. A transmission speed of about half a million words per minute was achieved at a demonstration of the equipment.

621.397.3 **1204**

The 'Reverse' Method for Designing the Output Stage of a Scanning System with a Magnetic Field.—K. V. Saprykin. (*Radiotekhnika, Moscow*, July/Aug. 1948, Vol. 3, No. 4, pp. 34–46. In Russian.) The shape of the output current curve is usually determined from the given input voltage curve and the parameters of the circuit. Here the value and shape of the input voltage is determined so that a sawtooth output current is obtained with given parameters of the circuit. The method is discussed in detail and a general equation (3) determining the input voltage is derived. The equation is then simplified by omitting the distributed capacitance of the coils in the circuit. The necessary jump in the input voltage and its total swing are determined by the scanning frequency, the duration of the flyback, and the time constants of the coils.

621.397.335 **1205**

Frame Synchronising Signal Separators.—A. W. Keen. (*Electronic Engng*, Jan. 1949, Vol. 21, No. 251, pp. 3–9.) Shortened version of 2386 of 1948.

621.397.335 **1206**

Locked Oscillator for Television Synchronization.—K. Schlesinger. (*Electronics*, Jan. 1949, Vol 22, No. 1, pp. 112–117.) 1948 Nationa Electronics Conference paper. Flywheel circuits are discussed as a simple alternative to automatic phase control.

621.397.5 **1207**

The Part Played by Russian Scientists in the Development of Television.—G. I. Golovin. (*Priroda*, Aug. 1948, No. 8, pp. 73–80. In Russian.)

621.397.5 **1208**

Television Waveforms: some Comparisons between British and American Standards.—(*Wireless World*, Dec. 1948, Vol. 54, No. 12, pp. 439–440.) Discussion with special reference to the sense of modulation and the inclusion of equalizing pulses in the synchronizing signals.

621.397.5 : 629.135 **1209**

Airliner Television.—(*Electronics*, Dec. 1948, Vol. 21, No. 12, p. 158.) Good reception from stations up to 180 miles away can be obtained with a commercial receiver. Alternative dipole aerials are provided.

621.397.5(083.74) **1210**

Comparison of Television Standards in Germany, England and America.—E. Schwartz. (*Arch. elekt. Übertragung*, Feb./March 1948, Vol. 2, Nos. 2/3, pp. 88–101.)

621.397.5(73) **1211**

Impressions of American Television.—T. M. C. Lance. (*J. Televis. Soc.*, Dec. 1947, Vol. 5, No. 4, pp. 132–138. Discussion, p. 139.) Report on the author's visit to the U.S.A. during March and April, 1947.

621.397.6 : 778.55 **1212**

Shutterless Television Film Projector.—L. C. Downes & J. F. Wiggin. (*Electronics*, Jan. 1949, Vol. 22, No. 1, pp. 96–100.)

621.397.62 **1213**

Television Receiver Design, Engineering, Manufacture.—(*Tele-Tech*, Nov. 1948, Vol. 7, No. 11, pp. 61–94.) A general survey of Philco methods.

621.397.62 **1214**

Televisor.—(*Electronic Engng*, Jan. 1949, Vol. 21, No. 251, p. 27.) Amendments to the booklet mentioned in 577 of 1948 (Flach & Bentley), with some additional notes.

621.397.62 : 535.88 **1215**

Projection-Television Receiver: Part 1 — The Optical System for the Projection.—P. M. van Alphen & H. Rinia. (*Philips tech. Rev.*, Sept. 1948, Vol. 10, No. 3, pp. 69–78.) For another account see 2387 of 1948.

621.397.62 : 621.398 **1216**

Television Remote Viewers.—V. Zeluff. (*Electronics*, Dec. 1948, Vol. 21, No. 12, pp. 90–93.) Video and audio signals from a receiver may be fed to a remote viewing unit which contains only power, audio and scanning circuits. Circuits, based upon U.S. television standards, are suggested for operating e.s. or magnetic c.r. tubes.

621.397.743 : 621.396.65.029.64 **1217**

6 000-Mc/s Television Relay System.—Forster. (*See* 1185.)

621.397.5 **1218**

Principes Fondamentaux de Télévision. [Book Review]—H. Delaby. Eyrolles, Paris, 200 pp. (*Radio tech. Dig., Édn franç.*, Dec. 1948, Vol. 2, No. 6, p. 285.) Part of the Collection du Centre d'Enseignement de la Radiodiffusion Française. A further volume devoted to basic techniques of broadcasting is in preparation. "An excellent course of instruction in the principles of television."

TRANSMISSION

621.396.61 **1219**

The Design of a 500 Watt M.F. General Purpose Transmitter.—W. J. Morcom. (*Marconi Rev.*, Oct./Dec. 1948, Vol. 11, No. 91, pp. 112–123.) A transmitter corresponding to that noted in 553 of February (Cooper), but covering the frequency range 275–550 kc/s.

621.396.61 **1220**

An Experimental Frequency-Modulated Broadcast Transmitter.—J. B. Rudd, W. W. Honnor & W. S. McGuire. (*J. Instn Engrs Aust.*, Sept. 1948, Vol. 20, No. 9, pp. 107–117.) Description of a 250-W transmitter for the range 88–108 Mc/s, including the modulator unit, power amplifier unit, aerial array and station monitor. The operation of the modulator depends upon the time delay when a f.m. signal is passed through a multisection band-pass filter. A signal from a fixed-frequency source is mixed with a f.m. signal from a modulated oscillator; the f.m. difference-frequency component is passed through a time-delay network and mixed with the original f.m. signal. The difference-frequency component of the output of this second mixing has the same centre frequency as the fixed source and is modulated in phase. Pure f.m. is obtained if the audio input is passed through an inverse-frequency network before application to the modulator.

621.396.61 : 621.316.726 **1221**

On the Stabilization of the Mean Frequency of F.M. U.S.W. Transmitters.—F. Kirschstein & D. Weber. (*Funk u. Ton*, Oct. 1948, Vol. 2, No. 10, pp. 499–515.) Discussion with special reference to the Crosby circuit (see 3294 of 1941) the Seeley discriminator (see 3802 of 1940) and the push-pull frequency modulator.

621.396.61 : 621.396.712 **1222**

KOMO's New 50 000 Watt Transmitter.—F. J. Brott & C. E. Miller. (*Broadcast News*, Oct. 1948, No. 51, pp. 45–50.) A general illustrated description. The end-fire aerial system consists of 3 aerials approximately 0.3 λ apart, mounted on 500-ft masts. See also 1186 above.

621.396.61 : 621.398 **1223**

The Keying of Radio Transmitters from Great Distances.—S. E. Kuteynikov. (*Vestnik Svyazi*, 1948, No. 9, pp. 21–22. In Russian.) Discussion of keying from a distance of several hundred kilometres by using the SMT-34 carrier system.

621.396.619.23 **1224**

Some Aspects of the Design of Balanced Rectifier Modulators for Precision Applications.—D. G. Tucker. (*J. Instn elect. Engrs*, Part III, Nov. 1948, Vol. 95, No. 38, p. 436.) Discussion on 3542 of 1948.

VALVES AND THERMIONICS

621.383 **1225**

On the Residual Current in Photoelectric Receivers of Very High Sensitivity.—M. Duchesne. (*C. R. Acad. Sci., Paris*, 29th Nov. 1948, Vol. 227, No. 22, pp. 1155–1157.)

621.383.4 **1226**

New Photoconductive Cells.—Schwarz. (*See* 1102.)

621.385 **1227**

Miniature Battery Valves.—O. P. Herrnkind. (*Funk-Technik, Berlin*, Sept. 1948, Vol. 3, No. 18, pp. 452–453.) Complete electrical data for the Tungsram h.f./m.f. pentode 1T4T, pentagrid frequency changer 1R4T, diode-l.f. pentode 1S5T and output pentodes 1S4T and 3S4T. Base connections and the circuit diagram of a receiver using these valves are also given.

621.385 **1228**

Quadrature Operation of Filamentary Gas Tubes.—V. L. Holdaway. (*Bell Syst. tech. Publ. Monogr. B*-1552, 4 pp.) Reprinted from *Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67. With anode and filament voltages in phase and the currents of comparable value, the non-uniformity of filament temperature may result in short tube life. With the voltages in quadrature the anode current may be increased to approximately double that permissible with in-phase operation.

621.385 : 621.396.822 : 621.396.645 **1229**

On the Influence of the Noise of Vacuum Tubes on the Accuracy of Linear Amplifiers.—J. M. W. Milatz & K. J. Keller. (*Physica, 's Grav.*, Jan. 1942, Vol. 9, No. 1, pp. 97–112. In English.) The noise of an RCA57 valve with floating grid is measured as a function of frequency. The source of this noise, and its effect on the precision of α-particle ionization measurement with this valve, are discussed.

621.385.001.4 : 621.317.3 **1230**

Quality Control for Receiving Valves and Industrial Applications.—Suart. (*See* 1117.)

621.385.032.21 **1231**

Cathodes with High Emission.—R. A. Oñativia. (*Rev. telegr., Buenos Aires*, Sept. 1948, Vol. 37, No. 432, pp. 635–638.) Discussion of the preparation, activation and characteristics of cathodes using (*a*) oxides of the alkaline earths, (*b*) ThO_2, (*c*) thoriated tungsten.

621.385.032.29 **1232**

The Calculation of Electrode Temperatures in the Radio Valve.—I. A. Harris. (*J. Brit. Instn Radio Engrs*, Nov./Dec. 1948, Vol. 8, No. 6, pp. 288–312. Discussion, pp. 312–315.) The theory of radiation equilibrium of typical electrode systems is developed and, in conjunction with the theory of conduction, the results are applied to the calculation of the temperature of each electrode. An example is worked out for the case of an output tetrode, which gives results in close agreement with typical measured temperature values for such a valve.

621.385.1 **1233**

The Consequences of an Electron-Inertia Effect in Valves: Part 2.—M. J. O. Strutt & A. van der Ziel. (*Physica, 's Grav.*, Jan. 1942, Vol. 9, No. 1, pp. 65–83. In German, with English summary.) Electrons, moving near electrodes, induce variable charges on them and hence currents in their leads. These currents are calculated for cases in which the electrodes are arranged so as to obtain maximum currents at very high frequencies impressed on the electron stream. The application of such electrode systems in v.h.f. amplifying valves to obtain high a.c. output is discussed; comparison is made with known arrangements giving lower output currents. By making use of electron oscillations about an electrode, the output currents can be further increased. The considerable input loss at h.f. can be compensated or even changed to a negative resistance by means similar to those used for increasing the output. Numerous curves illustrate the results of the discussion. Part 1, 254 of January.

621.385.1 **1234**

European Receiving Tubes.—H. A. S. Gibas. (*Electronics*, Feb. 1949, Vol. 22, No. 2, pp. 156..162.) The system of numbering generally adopted for different types of valve is explained and the special features of certain valves, including the Telefunken double tetrode VEL 11, are described.

621.385.1 : 621.316.726.078 **1235**

Tube Engineering News [the Transitrol].—J. Kurshan. (*Communications*, Jan. 1949, Vol. 29, No. 1, pp. 15, 33.) Summary of an I.R.E-R.M.A Rochester Fall meeting paper. The 'Transitrol' is a valve in which transit time effects, instead of being reduced to a minimum, are used to control the frequency of an oscillator automatically. Some electrons leave the cathode and go directly to the anode; their transit angles are small. These electrons contribute only to the transconductance of the valve. Others reach the anode indirectly after reflection and have large transit angles; these electrons contribute to the transsusceptance as well as the transconductance. By varying the reflector potential, the transsusceptance of the valve can be altered, and hence the frequency of the oscillations. The valve can also be used to generate a f.m. signal directly, by applying modulation to the reflector.

621.385.3 **1236**

Electrometer Valves.—B. M. Tsarev. (*Uspekhi fiz. Nauk*, 1948, No. 2, pp. 251–270. In Russian.) A detailed survey giving data on valves manufactured in Russia and elsewhere.

621.385.3/.4 : 537.291 **1237**

On the Phenomena in the Cathode-Grid Space of Triode and Tetrode Oscillators at Ultra High Frequencies.—M. S. Neiman. (*Radiotekhnika, Moscow*, July/Aug. 1948, Vol. 3, No. 4, pp. 7–25. In Russian.) Discussion of: (*a*) deviation of the emission current from the '2/3 power' voltage/current relationship, (*b*) the passage through the control grid of only those electrons which have left the cathode at the beginning of the emission interval, (*c*) the return of emitted electrons to the cathode, (*d*) the large ratio of the time interval during which the electrons pass through the grid to the interval during which they are emitted from the cathode, (*e*) variations in electron velocities after passage through the grid, and (*f*) acceleration of electrons by the grid. The simplifying assumption is made that all e.s. lines of force from the space charge are directed towards the cathode; a number of simple relationships are derived but these should be regarded only as approximate. Other phenomena due to the inertia of electrons in oscillators with flat electrodes are mentioned.

621.385.3 : 621.317.71 **1238**

Fluctuations in Electrometer Triode Circuits.—van der Ziel. (*See* 1123.)

621.385.38 **1239**

Recent Trends in the Construction of Thyratrons.—J. Bell. (*Bull. Soc. franç. Élect.*, Oct. 1948, Vol. 8, No. 85, pp. 489–495.) Discussion, mainly from the physical point of view, of thyratrons with Hg vapour, Ar or X as gas filling. The characteristics for these types are compared.

621.385.5 : 621.396.822 **1240**

Measurements of Noise Factors of Pentodes at 7.25-m Wavelength.—A. van der Ziel & A. Versnel. (*Philips Res. Rep.*, April 1948, Vol. 3, No. 2, pp. 121–129.)

621.385.831 : 621.318.25 **1241**

Residual Hum in Valves.—W. I. Heath: L. H. Light: W. Grey Walter, H. W. Shipton & W. J. Warren. (*Electronic Engng*, Dec. 1948, Vol. 20, No. 250, p. 406.) Comment on 3559 of 1948 and the authors' reply. Heath suggests that the effects reported may be due to magnetic fields produced by a mains transformer or a mains-operated heater. Light considers that demagnetization cannot reduce the magnetic hum in the EF37 unless the valves have previously been accidentally magnetized. Grey Walter, Shipton & Warren note that the difference between pentode and triode connection may be significant, but have observed much higher hum levels than Light.

621.385.832 **1242**

Three-Dimensional Representation on Cathode-Ray Tubes.—C. Berkley. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1948, Vol. 36, No. 12, pp. 1530–1535.) The procedure described may be applied to any regular system of coordinates or any number of variables. The representation may take the form of an oblique perspective picture. The procedure consists in: (*a*) setting the form of the representation, (*b*) deriving the position of the spot on the c.r. tube as a function of its true position in space, and (*c*) making the indicated corrections electrically. Applications in various fields are discussed. See also 577 of February (Parker & Wallis).

621.385.832 **1243**

The Negative-Ion Blemish in a Cathode-Ray Tube and its Elimination.—R. M. Bowie. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1948, Vol. 36, No. 12, pp. 1482–1486.) Removal of initiating substances, provision of a thin metallic backing layer for the screen, and particularly the use of ion traps, are suggested remedies.

621.396.615.142.2 **1244**

Multifrequency Bunching in Reflex Klystrons.—G. Hok. (*Proc. Inst. Radio Engrs, W. & E.*, Dec. 1948, Vol. 36, No. 12, p. 1505.) Comment on 2988 of 1948 (Huggins).

621.396.615.142.2 **1245**

Elementary Theory of the Klystron.—A. V. J. Martin. (*Radio tech. Dig., Édn franç.*, Oct. 1948, Vol. 2, No. 5, pp. 199–207.)

621.396.619.231 : 621.396.645.37 **1246**

Valve Characteristic Giving Linear Modulation when a Feedback Resistor is inserted in the Cathode Lead.—W. W. Boelens. (*Philips Res. Rep.*, June 1948, Vol. 3, No. 3, pp. 227–234.) The linearity of grid modulation is improved by the use of a feedback resistor in the cathode lead. Suitable anode-current/grid-voltage characteristics for given feedback resistances are derived theoretically.

621.396.822 **1247**

On the Theory of Electrical Fluctuations.—D. K. C. MacDonald. (*Proc. roy. Soc. A*, 7th Dec. 1948, Vol. 195, No. 1041, pp. 225–230.) Comment on 2419 of 1948 (Fürth). MacDonald regards Nyquist's own derivation of his theorem as valid rather than Fürth's suggested alternative. Fürth's method of applying Nyquist's theorem directly to a thermionic valve to obtain the current fluctuations is also criticized. See also 2418 of 1948 (Fürth).

621.385 : 533.583 **1248**

Production and Use of Getter Materials in German Radio Valves, Thermionic Devices generally, and Electric Lamps. [Book Notice]—(*See* 1105.)

621.396.615.142 **1249**

Velocity-Modulated Thermionic Tubes. [Book Review]—A. H. W. Beck. Cambridge University Press, London, 1948, 180 pp., 15s. (*Phil. Mag.*, Dec. 1948, Vol. 39, No. 299, p. 1005.) One of the Modern Radio Technique series edited by J. A. Ratcliffe. ". . . a very useful addition to the literature on the subject, presenting much that has only been available in scattered, recent papers."

MISCELLANEOUS

522.1 **1250**

Proceedings of Observatories.—(*Mon. Not. R. astr. Soc.*, 1948, Vol. 108, No. 1, pp. 54–60.) Brief discussions of recent work at various observatories all over the world.

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

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ACOUSTICS AND AUDIO FREQUENCIES

534 **1251**

Sound.—E. G. Richardson. (*Rep. Progr. Phys.*, 1942/1943, Vol. 9, pp. 228–253. Bibliography, pp. 253–255.) A general discussion, covering propagation in free media, ultrasonics, vibrating systems, acoustic impedance and properties of materials, speech and hearing, etc.

534 **1252**

Sound.—E. G. Richardson. (*Rep. Progr. Phys.*, 1944/1945, Vol. 10, pp. 120–128.) Discussion of auditorium acoustics, metallurgical applications of ultrasonics, musical scales and tuning. See also 1251 above.

534 **1253**

Some Recent Developments in Applied Acoustics.—R. G. Bolt & L. L. Beranek. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 225–251. In English.) Adequate progress has already been made with the understanding of (*a*) the basic principles of many electroacoustic instruments, (*b*) speech and hearing, though many physiological and psychological phenomena are still unexplained, and (*c*) the control of sound by porous absorptive materials. Further work is needed on (*a*) the transient response of loudspeakers and complicated coupled systems, (*b*) the study of all kinds of distortion, and (*c*) the design of studios for music.

534.001.8 **1254**

Generation of Sonic and Ultrasonic Waves in Liquids for Industrial Purposes.—Janovsky & Pohlman. (*See* 1442.)

534.321.9 : 621.391.63 **1255**

On the Modulation of Light at Radio Frequencies by means of Ultrasonic Waves.—A. Giacomini. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 302–311. In Italian.) See also 1847 of 1948.

534.44 **1256**

Electrical Methods of Sound Analysis.—H. Koschel. (*Fernmeldetech. Z.*, Dec. 1948, Vol. 1, No. 9, pp. 237–244.) An outline of the following methods: (*a*) Fourier analysis of oscillograms, (*b*) use of octave band-filters with oscillograph, (*c*) sonic-frequency spectrometer with 27 filters in parallel, each covering 1/3 octave, (*d*) search-tone analysis, (*e*) analysis by means of an acoustic diffraction grating, (*f*) analysis with an optical raster, (*g*) visible-speech methods.

534.6 **1257**

The Double Crystal Acoustic Interferometer.—W. J. Fry. (*J. acoust. Soc. Amer.*, Jan. 1949, Vol. 21, No. 1, pp. 17–28.) A one-dimensional theory of operation is discussed. This is sufficiently general to include both resonance and off-resonance operation, and any amount of acoustic loading of the crystals.

534.6 : 621.396.611.21 **1258**

Low-Loss Crystal Systems.—Fry. (*See* 1326.)

534.756 **1259**

Hearing: Part 1 — The Cochlea as a Frequency Analyser.—T. Gold & R. J. Pumphrey. (*Proc. roy. Soc. B*, 14th Dec. 1948, Vol. 135, No. 881, pp. 462–491.) Possible methods of sensory appreciation of sounds are briefly surveyed. Information must in general be lost unless peripheral frequency analysis occurs under certain conditions which include proportionality between the frequency and the selectivity of the resonant elements. Experimental evidence is submitted which shows that this selectivity is very much higher than has been supposed and is roughly proportional to frequency, and that only the Helmholtz resonance theory, suitably interpreted, is consistent with observation. Evidence of high cochlear damping is criticized. The ear appears to be a perfect frequency analyser up to 1 kc/s; at higher frequencies it is imperfect because of the limited number of resonant elements and nerve cells available. Part 2: 1260 below.

534.756 **1260**

Hearing: Part 2 — The Physical Basis of the Action of the Cochlea.—T. Gold. (*Proc. roy. Soc. B*, 14th Dec. 1948, Vol. 135, No. 881, pp. 492–498.) An attempt is made to explain observed results theoretically. The values of Q for a string immersed in water (to simulate the basilar membrane immersed in its liquid) are much lower than those obtained for the human ear. For this reason the hypothesis that the cochlea behaves like a regenerative radio receiver is proposed. Part 1: 1259 above.

534.78 **1261**

Speech Communication under Conditions of Deafness or Loud Noise.—W. G. Radley. (*J. Instn elect. Engrs*, Part I, Dec. 1948, Vol. 95, No. 96, pp. 544–545.) Discussion on 2690 of 1948.

534.78 **1262**

Statistical Measurements of Vocal Intensity.—G. Sacerdote. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 389–401. In Italian.)

534.782 **1263**

On a Model of an Artificial Voice for Electroacoustic Technique.—P. Chavasse. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 273–279. In French.) A sound source whose intensity is nearly uniform with frequency is provided by an e.m.f. from a neon tube suitably polarized, associated with an amplifier and a loudspeaker. Any desired quality of voice can be obtained by adding a system of filters.

534.844/.845 **1264**

The Absorption Coefficient of Resonators.—G. G. Sacerdote. (*Alta Frequenza*, Oct. 1948, Vol. 17, No. 5, pp. 217–219. In Italian, with English, French and German summaries.) Curves show the reverberation times as a function of frequency for a room (*a*) without and (*b*) with a cellular lining consisting of tubular resonators. From these curves the absorption coefficient of a partition formed of the resonators is derived for the frequency range 300–2 000 c/s.

534.844.1 **1265**

The Practical Determination of the Reverberation Time of a Room with the Cathode-Ray Oscillograph.—A. Moles. (*Radio franç.*, Feb. 1949, No. 2, pp. 4–8.) Reverberation curves can be photographed directly on slowly moving film (4–10 cm/s) without using the c.r.o. timebase, or on a stationary film, in which case the necessary slow sweep is obtained by means of a rotary potentiometer of about 5 000 Ω, which is shunted across a 150-V source and supplies a variable voltage to the deflecting plates. The potentiometer is driven by a small motor of the type used for car wind-screen wipers. Typical oscillograms thus obtained are given and the method of calculating the reverberation time, taking account of oscillogram irregularities, is explained in detail with numerical examples.

534.86 **1266**

Listeners' Sound-Level Preferences.—T. Somerville & S. F. Brownless. (*B.B.C. Quart.*, Jan. 1949, Vol. 3, No. 4, pp. 245–250.) A sound-level meter incorporates a weighting network which simulates the response of the ear. Members of the public of varying ages, B.B.C. engineers and musicians were tested with this device; results obtained are shown graphically. The preferred maximum sound level of the four types of programme chosen for the tests appears to decrease as the age of the listener increases.

534.861 : 621.396.621 **1267**

The Acoustics of Broadcasting Receivers.—V. A. Govyadinov. (*Radiotekhnika, Moscow*, Nov./Dec. 1948, Vol. 3, No. 6, pp. 88–95. In Russian.)

621.395.61 **1268**

A New Moving-Coil Microphone.—H. J. Griese. (*Fernmeldetech. Z.*, Dec. 1948, Vol. 1, No. 9, pp. 227–232.) Details of an instrument with a sensibly flat characteristic up to 6 kc/s for sound incident normally on the diaphragm and up to 10 kc/s for lateral incidence. The directional diagram is spherical up to about 1 500 c/s; for higher frequencies it is slightly pear-shaped. Sensitivity is good and nonlinear distortion low.

621.395.61/.62 : 621.315.612 **1269**

Application of Activated Ceramics to Transducers.—H. W. Koren. (*J. acoust. Soc. Amer.*, Jan. 1949, Vol. 21, No. 1, p. 62.) Summary of Acoustical Society of America paper. Titanate ceramics can be made to have piezoelectric properties suitable for application to transducers if (*a*) the Curie point is well above the working temperature, (*b*) the material is polarized by means of an external voltage source within certain limits of potential gradient and time duration. Multi-layer strips have been developed to provide the low mechanical impedance required in gramophone pickups, microphones etc.

621.395.625.6 **1270**

Volume Compressors for Sound Recording.—W. K. Grimwood. (*J. Soc. Mot. Pict. Engrs*, Jan. 1949, Vol. 52, No. 1, pp. 49–76.) Discussion of the desirability of volume compression, compressor characteristics, classification, performance measurement, and the relative merits of various types.

621.395.667 **1271**

On Lower- and Upper-Register RC Equalizers for Audio Frequencies.—W. Daudt. (*Funk u. Ton*, Jan. & Feb. 1949, Vol. 3, Nos. 1 & 2, pp. 33–42 & 86–92.) A general treatment, with design formulae and curves, and detailed discussion of three particular cases. A design is given for a resistance amplifier with correction at both ends of the a.f. range.

621.395.667 **1272**

Simple Tone Control Circuit.—E. J. James. (*Wireless World*, Feb. 1949, Vol. 55, No. 2, pp. 48–50.) Adequate reduction or increase of bass or treble is obtained for normal requirements. Only resistors and capacitors are required. The complete circuit diagram for including the control in an amplifier is given.

AERIALS AND TRANSMISSION LINES

621.3.091 : 621.315.2 **1273**

Attenuation in Air-Space Cables for Centimetre Waves.—H. J. Wegener & O. Zinke. (*Frequenz*, Aug. 1948, Vol. 2, No. 8, pp. 203–207.) Diagrams show directly the reduction of attenuation, compared with that of a coaxial cable for TM and TE waves, as a function of frequency and cable diameter. From other diagrams the optimum diameter for a given value of attenuation can be found for any wavelength in the range 1–15 cm. For wavelengths of 2.5, 5, 7.5 and 10 cm, the dependence of attenuation on cable diameter is shown for all types of air-space cables. For wavelengths < 2.5 cm the attenuation for H_{11} waves is less than for H_{10} waves.

621.315.012 : 518.3 **1274**

R.F. Transmission Line Nomographs.—P. H. Smith. (*Electronics*, Feb. 1949, Vol. 22, No. 2, pp. 112–117.) 10 abacs for calculating characteristic impedance, h.f. resistance, current-phase relationship, voltage gradient, s.w.r. etc.

621.315.2 + 621.394/.395 **1275**

French Telecommunication Networks.—Mailley; Gastebois. (*See* 1492.)

621.315.2 + 621.394/.395].66 **1276**

Construction of Cables and Loading Coils.—R. Belus. (*Câbles & Transmission, Paris*, Jan. 1949, Vol. 3, No. 1, pp. 31–47. With English summary.) Developments in technique from 1924 to 1949.

621.315.2 **1277**

The Laying of Long-Distance Cables.—M. Trouble. (*Câbles & Transmission, Paris*, Jan. 1949, Vol. 3, No. 1, pp. 48–65. With English summary.) Historical review of French methods.

621.315.212 : 621.392.5 **1278**

Coaxial Cable with High Characteristic Impedance.—J. A. Hodelin. (*Radio franç.*, Feb. 1949, No. 2, pp. 23–24.) A formula is derived for the impedance of a cable with a helix of small diameter for the central conductor. Calculated and measured values of impedance for such delay lines are in good agreement. See also 2009 of 1947 (Zimmermann).

621.315.212 : 621.397.5 **1279**

The London-Birmingham Television Cable: Part 1 — General System and Electrical Requirements.—H. Stanesby & W. K. Weston. (*P.O. elect. Engrs' J.*, Jan. 1949, Vol. 41, Part 4, pp. 183–188.) The cable has two 0.975-in. and four 0.375-in. coaxial tubes. It is designed to transmit very-high-definition or colour television, 405-line television and broad-band telephony simultaneously. The large tubes may ultimately transmit frequencies up to 30 Mc/s or more with repeaters at 3-mile intervals.

621.392.2 **1280**

Study of Reflections in Transmission Lines at U.H.F.—M. Bouix. (*Onde élect.*, Jan. 1949, Vol. 29, No. 262, pp. 35–43.) The reflections caused by one, and next by two obstacles in the line are considered; an obstacle of a given length is equivalent to a unique concentrated obstacle. The case of many obstacles is then examined. In practice, the frequency is only known approximately, and in the case of magnetron oscillations the frequency may even jump or split into two. These differences from the nominal frequency produce phase variations of the waves reflected by obstacles, thus causing variations of the amount of the stationary waves. Assuming such phase variations to be distributed at random, the probability of good matching being obtained is considered. A practical matching method is described.

621.392.2 **1281**

Propagation of Plane Electromagnetic Waves in a Multi-Layer Medium of Periodic Structure.—M. L. Levin. (*Zh. tekh. Fiz.*, Nov. 1948, Vol. 18, No. 11, pp. 1399–1404. In Russian.) The effect of equidistant dielectric spacers on the propagation of e.m. waves in cables and waveguides is usually considered in terms of the coefficient of reflection from a single spacer. This procedure is unsatisfactory since the equidistant spacers form a periodic structure causing dispersion of the signal and attenuating certain frequency bands. Accordingly, a dispersion equation (11) is derived, and analysed in detail for the cases where the wavelength is (*a*) long, and (*b*) short, in comparison with the distance between the spacers. Methods for determining the frequency bands attenuated are also indicated.

621.392.21 **1282**

Simplified Procedure for Computing Behavior of Multiconductor Lossless Transmission Lines.—S. Frankel. (*Elect. Commun.*, Sept. 1948, Vol. 25, No. 3, pp. 286–290.) Summary noted in 2443 of 1948. The wave equation for any lossless system of parallel conductors is derived in terms of the characteristic impedance or admittance coefficients obtained directly from the partial capacitances of pairs of the conductors. Illustrative examples are discussed.

621.392.26† **1283**

Theory of Symmetrical Waves in a Circular Waveguide with an Open End.—L. A. Weinstein. (*Zh. tekh. Fiz.*, Dec. 1948, Vol. 18, No. 12, pp. 1543–1564. In Russian.) A mathematical analysis of the propagation of symmetrical electric and magnetic waves in a circular waveguide towards the open end. An integral equation (7) determining the current density in the wall of the waveguide is derived and methods for its solution are proposed. Coefficients of reflection of the waves from the open end are calculated and also the coefficients of transformation of the waves into waves of different modes. Huyghens' principle for calculating the diffraction field is discussed; formulae and graphs for determining the radiation field of the waveguide are derived. Approximate formulae of adequate accuracy involving simple calculations are also given.

621.392.26† **1284**

A Note on Reflection from Dielectric Structures in Wave Guide.—J. Shmoys. (*J. appl. Phys.*, Aug. 1948, Vol. 19, No. 8, p. 797.) A method of representing the effect of an obstacle in a waveguide by the equivalent capacitive loading on a transmission line, valid for obstacles of small cross-section.

621.392.26† **1285**

The Calculation of the Critical Frequency of Waveguides with Π or H Cross-Section.—L. N. Deryugin. (*Radiotekhnika, Moscow*, Nov./Dec. 1948, Vol. 3, No. 6, pp. 49–61. In Russian.) General formulae are derived linking the critical frequency of the H_{10} wave with the cross-sectional dimensions of the waveguide. From these formulae graphs are obtained for use in design work. Some limiting cases are considered separately.

621.392.26† **1286**

The Theory of Disk-Loaded Wave Guides.—W. W. Hansen. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 111–132. In English.) The phase velocity in a circular waveguide can be reduced to any desired value by introducing equally-spaced baffles or disks. The group velocity can also be controlled, and the structure may be regarded as a band-pass filter. The characteristics of such structures are evaluated by various methods and shown graphically.

621.392.26† : 621.3.09 **1287**

Theory of the Propagation of an E.M. Field along a Dielectric Waveguide of Circular Cross-Section.—M. Abele. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 3–13. In Italian.) If the waveguide is lossless, two distinct types of e.m. modes can be set up in which the longitudinal components E_1, H_2 of the electric and magnetic field are both present, except in the case of waves of order zero. For all other orders, there is a fundamental mode which can be propagated longitudinally whatever the frequency. All other modes possess a cut-off frequency, below which only transverse propagation is possible.

If the conductivity is small compared to the product of the frequency and the permittivity of the dielectric, the attenuation tends, for increasing frequency, to a limit independent of the mode and of the diameter of the guide.

621.392.26† : 621.3.09 **1288**

Rectangular Waveguides with Several Dielectrics.—M. Abele & C. M. Garelli. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 14–29. In Italian.) The case of two dielectrics is here considered. Results can easily be extended to the general case provided there is symmetry about a central plane. In a metallic guide, dielectrics can be chosen to obtain any desired configuration and in particular a plane wave within a given region. Transformers and filters can be constructed in this way. The radiation diagram of a waveguide open at one end can be much altered by the use of dielectrics, and directivity can be greatly increased.

621.392.26† : 621.317.335.3† **1289**

Universal Curves for Dielectric-Filled Wave Guides and Microwave Dielectric Measurement Methods for Liquids.—Surber. (*See* 1433.)

621.392.26† : 621.392.52 **1290**

Maximally-Flat Filters in Waveguide.—Mumford. (*See* 1320.)

621.396.67 **1291**

Microwave Beam-Shaping Antennas.—L. J. Chu. (*Atti del Congresso internazionale della Radio, Rome,* Sept./Oct. 1947, pp. 52–64. In English.) Optical ray principles are applied to line sources with cylindrical reflectors, line sources with lenses, and point sources with double-curvature reflectors to produce radiation diagrams of any desired shape. The cosecant diagram is specially considered.

621.396.67 : 538.56.029.8 **1292**

Microwave Optics between Parallel Conducting Sheets.—H. B. De Vore & H. Iams. (*RCA Rev.*, Dec. 1948, Vol. 9, No. 4, pp. 721–732.) Discussion of various microwave systems which focus in one plane only. These range from simple lens-like elements to more elaborate systems involving dielectric elements. They produce a fan-shaped beam of radiation which may be converted to a pencil beam by using cylindrical reflectors or lenses to focus in the perpendicular direction. A method of scanning in this direction is described.

621.396.67 : 621.396.93 **1293**

An Investigation of Resonances and Asymmetry in the Adcock Aerial Systems.—A. Z. Fradin & V. A. Khatskelevich. (*Radiotekhnika, Moscow,* Nov./Dec. 1948, Vol. 3, No. 6, pp. 6–28. In Russian.) A rigorous analysis is given of the resonance phenomena taking place in the H-type Adcock system (Fig. 1), in order to determine the type and magnitude of errors introduced into the system by asymmetry in various elements. The usual practice of identifying the frequency characteristic of the system with that of its input impedance appears in general to be incorrect.

621.396.671 **1294**

On the Radiation Resistance of a Radiator surrounded by a Spherical Magneto-Dielectric Envelope.—A. R. Vol'pert. (*Radiotekhnika, Moscow,* Nov./Dec. 1948, Vol. 3, No. 6, pp. 29–48. In Russian.) It is often necessary to reduce the physical length of a linear vibrator without decreasing its radiation resistance. Methods for increasing the effective length of the vibrator have been considered by various authors. Pistol'kors examined the effect of a dielectric envelope in the form of an infinitely long cylinder. Here a spherical envelope is considered, because this shape allows a rigorous solution (34) to be obtained, based on Maxwell's equations and the corresponding boundary conditions. This solution involves only elementary functions. The effects of the permeability and permittivity of the sphere and of its radius on the radiation resistance of the vibrator are examined in detail. The physical interpretation of the results is discussed ; it can be extended to other shapes of envelope.

621.396.671 **1295**

Mutual Impedance of Two Centre-Driven Parallel Aerials.—B. Starnecki & E. Fitch. (*Wireless Engr,* Dec. 1948, Vol. 25, No. 303, pp. 385–389.) A formula and curves are given for symmetrically placed aerials with a sinusoidal current distribution. Measurements at frequencies from 3 to 20 Mc/s, using vertical aerials above a horizontal earth mat 400 ft in diameter, are in fair agreement with theory.

621.396.671 **1296**

Ring-Aerial Systems.—H. Page. (*Wireless Engr,* Dec. 1948, Vol. 25, No. 303, p. 402.) Correction to 308 of February.

621.396.671 **1297**

The Radiation Patterns of Dielectric Rods — Experiment and Theory.—R. B. Watson & C. W. Horton. (*J. appl. Phys.*, July 1948, Vol. 19, No. 7, pp. 661–670.) The radiation from rods used as terminations to rectangular waveguides is discussed theoretically. Radiation patterns are computed from the fields due to equivalent magnetic and electric currents on the surfaces of the rods. Specific calculations are made for rods of cross-section about 0.9 in. × 0.25 in. and 3λ–10λ long, in the $TE_{0,1}$ mode. Theoretical and experimental patterns for polystyrene rods 3λ–6λ long are in agreement. Discrepancies for longer rods are discussed.

621.396.679.4 **1298**

A Method of Feeding Turnstile Antennas.—R. E. Taylor. (*Electronics,* Feb. 1949, Vol. 22, No. 2, pp. 164 .. 170.) To obtain correct phasing, the dipoles are fed by separate coaxial feeders whose physical lengths are equal, but whose electrical lengths differ by λ/4. This is achieved by using different dielectric materials in the feeders. The characteristics of the feeders for the aerial used in telemetering from V-2 rockets (2536 and 3242 of 1947) are discussed.

621.396.679.4 : 621.392.43 **1299**

High-Frequency Balancing Devices.—Meinke. (*See* 1314.)

621.396.671 **1300**

Radio Research Special Report No. 16: A Method of Determining the Polar Diagrams of Long Wire and Horizontal Rhombic Aerials. [Book Notice]—W. R. Piggott. H.M. Stationery Office, London, 1948, 9d. (*Govt Publ., Lond.*, Dec. 1948, p. 14.)

CIRCUITS AND CIRCUIT ELEMENTS

621.3.015.3 : 621.396.622 **1301**

Transient Processes in detecting an E.M.F. with a Linearly Increasing Amplitude.—R. D. Leites. (*Radiotekhnika, Moscow,* Nov./Dec. 1948, Vol. 3, No. 6, pp. 62–75. In Russian.)

621.3.018.7 : 621.396.813 **1302**

Trapezoidal Waveform with Minimal Distortion.—W. Bader. (*Frequenz,* Aug. 1948, Vol. 2, No. 8, p. 208.) Comment on 2470 of 1948 (Päsler), in which ' distortion ' should be substituted for ' noise factor ' in both title and text, and whose U.D.C. number should be as above.

621.3.018.7 : 621.396.813 **1303**

A Representation of the Distortion Formula in Closed Form.—M. Päsler. (*Frequenz,* Aug. 1948, Vol. 2, No. 8, pp. 208–210.) The so-called completeness condition (Parseval's equation), which expresses the sum of the squares of the coefficients in the series development of an arbitrary function $F(z)$ in the form of a definite integral, enables the usual expression for the distortion χ to be put into a closed form. The general formula is given and applied to the case where $F(z)$ is represented by a Fourier series. When $F(z)$ has certain symmetrical properties, relatively simple formulae for χ are obtained. See also 2470 of 1948 and 1302 above.

621.314.3† **1304**

Simplified Magnetic Amplifier.—M. Marinescu. (*Wireless Engr,* Dec. 1948, Vol. 25, No. 303, p. 402.) Comment on 315 of February (Bell). An alternative type of amplifier, giving balance of output current for zero signal input, proportionality between output and input, and discrimination in the response to inputs of different polarity, is briefly discussed with illustrative diagram.

621.314.3† : 623.82 **1305**

Magnetic Amplifiers for Shipboard Applications.—L. W. Buechler. (*Elect. Engng, N.Y.*, Jan. 1949, Vol. 68, No. 1, pp. 33–37.) Advantages include: ruggedness and reliability; no real limitation on power handled; no warming-up time; power can be taken direct from the 50-c/s mains, although speed of response increases with increasing frequency; power gains of 1 000–10 000 per stage are possible with response times of 0.005–0.1 sec; power gains up to 10^8 can be obtained with response times of 1–5 sec. Design principles and relevant properties of magnetic materials are discussed.

621.318.4 **1306**

Calculation of *Q* for Single-Layer Coils.—F. Benz. (*Elektrotech. u. Maschinenb.*, Jan. 1949, Vol. 66, No. 1, pp. 7–12.) A formula is derived which gives results in good agreement with measured values. The effects of self-capacitance and dielectric losses and the reduction of Q by magnetic screens are discussed. A simple empirical formula is also given for the inductance of single-layer coils.

621.319 : 679.5 **1307**

Electrostatic "Magnets".—(*Elect. Times*, 9th Dec. 1948, Vol. 114, No. 2979, p. 696.) Electrets, dielectric bodies which can retain an electric moment after an externally applied field has been removed, can be made from certain ceramic or plastic materials. The plastics require an e.m.f. of 4–12 kV for satisfactory electrification. Specimens tested after a year have not changed their electrical properties appreciably.

621.319.4.011.5 : 519.272 **1308**

The Theory of Extreme Values and its Implications in the Study of the Dielectric Strength of Paper Capacitors.—B. Epstein & H. Brooks. (*J. appl. Phys.*, June 1948, Vol. 19, No. 6, pp. 544–550.) Statistical theory of the distribution of extreme values is used to deduce the dependence of paper-capacitor breakdown on capacitor size.

621.362 **1309**

Thermomagnetic Generator.—L. Brillouin & H. P. Iskenderian. (*Elect. Commun.*, Sept. 1948, Vol. 25, No. 3, pp. 300–311.) A mathematical analysis of an electric generator using a coil wound on a core of high permeability through which a magnetic field is maintained by an external magnet. The core is heated above and cooled below the Curie point, and the resulting changes in flux induce electromotive forces in the coil. Expressions are derived for the optimum power and efficiency of such a generator.

621.385.012 **1310**

The Correspondence between the Static Characteristics and the Dynamic Parameters of Electrical Negative-Resistance Devices.—Cartianu. (*See* 1542.)

621.385.012.8 **1311**

Equivalent Circuit and Input Admittance of Retarding-Field Valves.—A. Pinciroli & R. Ferrero. (*Alta Frequenza*, Oct. 1948, Vol. 17, No. 5, pp. 196–211. In Italian, with English, French and German summaries.) Assuming transit-time effects and control-grid current can be neglected, an expression is derived for the equivalent input admittance of a retarding-field valve used as a negative-transconductance triode. For the case of a resistive output impedance, the equivalent input capacitance and conductance variations are plotted as functions of the ratio of output impedance to the differential resistance of the valve, with the differential resistance as a parameter. Discussion of the case of two distinct output impedances shows that when these consist of resistances of suitable value, the input admittance can be made zero and, within certain frequency limits, independent of frequency.

621.392 **1312**

Relation between Amplitude and Phase in Electrical Networks.—T. Murakami & M. S. Corrington. (*RCA Rev.*, Dec. 1948, Vol. 9, No. 4, pp. 602–631.) A simple graphical method is presented for computing the phase curve from a given amplitude characteristic, and the attenuation characteristic from a given phase curve in a minimum phase-shift network. A large number of universal curves are given, to simplify the application of the theory.

621.392 : 517.43 **1313**

History of the Operational Calculus as Used in Electric Circuit Analysis.—T. J. Higgins. (*Elect. Engng, N.Y.*, Jan. 1949, Vol. 68, No. 1, pp. 42–44. Bibliography, pp. 44–45.)

621.392.43 : 621.396.679.4 **1314**

High-Frequency Balancing Devices.—H. H. Meinke. (*Fernmeldetech. Z.*, Nov. 1948, Vol. 1, No. 8, pp. 193–199.) Description of various arrangements for converting from an unsymmetrical feeder, such as a coaxial cable, to the symmetrical type of feeder required for a dipole.

621.392.5 **1315**

Equivalent Circuits of Linear Active Four-Terminal Networks.—L. C. Peterson. (*Bell Syst. tech. J.*, Oct. 1948, Vol. 27, No. 4, pp. 593–622.) The representation of a triode as a linear quadripole and the concept of 'effective transconductance' are examined. Electron transit-time effects and circuit behaviour were considered independently in earlier theories. The present paper develops a more general theory of active linear quadripoles, in which circuit and electron-stream parameters are combined in a single equivalent-circuit representation. It is shown that the equations for current or voltage equilibrium may yield a number of alternative T or Π networks, the passive elements of which represent faithfully any three of the four independent parameters. The method is applied to grounded-cathode, grounded-grid or grounded-anode triodes, and the complete sets of quadripole parameters are listed, together with approximate parameters and equivalent circuits for moderately low frequencies.

621.392.5 **1316**

Generalized Quadripoles.—R. Malvano. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 141–159. In Italian.) A general theory is developed for the case of axial symmetry, and applied to the study of filters and impedance transformers.

621.392.52 **1317**

New Methods of Filter Design by means of Frequency Transformations.—G. Neovius. (*Kungl. tekn. Högsk. Handl., Stockholm*, 1946, No. 3, 40 pp. In English.) Frequency transformations, discussed by Laurent (1339 of 1938), replace the angular frequency by a function thereof which has the dimensions of radians/sec, and also multiply all impedances by a dimensionless function. Such transformations are further examined, and a tabular method of calculation is considered and applied to the following process of filter design: (*a*) the required attenuation curve of the filter in the real-frequency region is converted to the negative imaginary-frequency region and plotted on a logarithmic scale; (*b*) an approximation to the curve thus obtained is derived from the attenuation curves of all-pass filter sections; (*c*) attenuation peaks are re-transformed to the real-frequency region; (*d*) the characteristic frequencies thus obtained are used for designing L-sections which can be connected in cascade to form the requisite filter. Numerical examples are given.

621.392.52 : 517.53 **1318**

Splitting of an Analytical Function into a Linear and a Nonlinear Part, and also a Method of Determining, for a Known Linear Component, the Nonlinear Component and the Function as a Whole.—Pleijel. (*See* 1422.)

621.392.52 : 517.727 **1319**

Application of sn Elliptic Functions to the Calculation of Filters.—K. Steffenhagen. (*Funk u. Ton*, Jan. 1949, Vol. 3, No. 1, pp. 44–47.)

621.392.52 : 621.392.26† **1320**

Maximally-Flat Filters in Waveguide.—W. W. Mumford. (*Bell Syst. tech. J.*, Oct. 1948, Vol. 27, No. 4, pp. 684–713.) Good match within the pass band and efficient suppression outside it are achieved by giving the loss characteristic the greatest possible number of zero derivatives at mid-band. The required loaded *Q*s of the resonant elements are given, and it is shown that sections of waveguide between elements reduce mutual coupling and allow the use of shunt reactances only. Loaded *Q*s are given for resonant cavities formed by various reactive obstacles. Up to 75 obstacles have been used in practice, giving good agreement with theory.

621.392.6 : 512.831 **1321**

Transmission Losses in 2*n*-Terminal Networks.—V. Belevitch. (*J. appl. Phys.*, July 1948, Vol. 19, No. 7, pp. 636–638.) The efficiency matrix is defined for such networks, and its application to the solution of reactive and resistive, transformer-type, and general 2*n*-terminal network problems is discussed.

621.394/.395].66 + 621.315.2 **1322**

Construction of Cables and Loading Coils.—Belus. (*See* 1276.)

621.396.611.1 : 518.4 **1323**

Graphical Solution of Oscillation Problems in Circuits with Negative Resistance.—A. Sabbatini. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 374–388. In Italian.) Discussion of various circuits of the dynatron and arc types. Current/voltage curves are obtained by a geometrical construction; a method of deducing the waveform is given.

621.396.611.1 : 621.3.015.3 **1324**

The Occurrence of Needle Impulses and their Effect on the Transient Behaviour of Forced Oscillations.—M. Päsler. (*Frequenz*, Dec. 1948, Vol. 2, No. 12, pp. 322–331.)

621.396.611.1 : 621.317.6 **1325**

Erratum: Response of Linear Resonant Systems to Excitation of a Frequency Varying Linearly with Time.—G. Hok. (*J. appl. Phys.*, July 1948, Vol. 19, No. 7, p. 623.) Correction to 671 of March.

621.396.611.21 : 534.6 **1326**

Low-Loss Crystal Systems.—W. J. Fry. (*J. acoust. Soc. Amer.*, Jan. 1949, Vol. 21, No. 1, pp. 29–34.) Discussion of the effect of damping or resistive mechanical loads on the characteristics of a piezoelectric crystal system vibrating in either a longitudinal or a thickness mode. Results are applied to the double crystal acoustic interferometer (1257 above).

621.396.611.3 : 517.942 **1327**

On Linear Differential Equations with Slowly Variable Coefficients. Application to the Study of Nonlinear Coupling.—Blânc. (*See* 1423.)

621.396.611.3 : 621.396.813 **1328**

On the Reduction of Phase Distortion in Stages with Coupled Circuits.—J. Laplume. (*C. R. Acad. Sci., Paris*, 8th Dec. 1948, Vol. 227, No. 23, pp. 1213–1215.) The case of two coupled resonant circuits tuned to the same frequency is analysed in a manner analogous to that used for stagger-tuned circuits (681 of March). It is not found possible to annul the second-degree term in the formula obtained for the phase distortion, but the third-degree term can be annulled by suitable choice of the coupling coefficient k. When both circuits have the same Q, $k = 1/Q\sqrt{3}$. The top of the output amplitude curve is rounded, in agreement with a general rule given previously (40 of January).

621.396.611.4 **1329**

The Radiation of Oscillations from a Cavity Resonator through an Aperture as an Analogue of the Tunnel Effect.—P. E. Krasnushkin & E. R. Mustel'. (*Zh. tekh. Fiz.*, Nov. 1948, Vol. 18, No. 11, pp. 1378–1393. In Russian.)

621.396.611.4 **1330**

On Avoiding Low Frequencies in a Rectangular Cavity Resonator used as Part of a Triode Generator.—K. F. Niessen. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 312–329. In English.) A mathematical analysis of optimum shapes and proportions for resonators built up from rectangular units to exclude resonances at frequencies below that desired. Other shapes where the cross-section is made up of triangles are also discussed.

621.396.611.4.029.64 **1331**

Design of a Resonant Cavity for Frequency Reference in the 3 cm Range.—R. R. Reed. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 364–373. In English.) Discussion of the design and performance of a temperature-compensated resonator, suitable for quantity production, having a frequency error of less than 1 Mc/s and a loaded Q of 2 000.

621.396.615 + 621.396.645 **1332**

Limits of Tube-Gain and Power Output at Extreme High Frequencies.—M. J. O. Strutt. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 655–667. In English.) Amplifier and oscillator stages without feedback are discussed. A formula for the optimum gain is derived. The importance of the 'border' frequency at which this gain drops to unity is stressed; the gain formula is transformed in various ways according to the type of reception valve to which it is applied. Grounded-cathode and grounded-grid stages are compared. The theory does not cover travelling-wave valves, with which an effective bandwidth of 800 Mc/s at 3 300 Mc/s has been successfully amplified. Similitude rules for determining the frequency dependence of the power output of power valves at u.h.f. are tabulated and discussed.

621.396.615 **1333**

High-Stability Pilot Generator for the 3.5-Mc/s and 7-Mc/s Bands.—L. Liot. (*Radio franç.*, Jan. 1949, No. 1, pp. 21–23.) An electron-coupled oscillator using a single EL39 valve. The tuned-anode output circuit is isolated from the oscillator by connecting the suppressor grid directly to earth. Both high- and low-impedance outputs are provided. Performance figures for different load resistances are tabulated.

621.396.615 : 621.396.645 **1334**

The Theory of the Oscillator using a Cathode-Coupled Amplifier.—G. A. Khavkin. (*Zh. tekh. Fiz.*, Nov. 1948, Vol. 18, No. 11, pp. 1416–1420. In Russian.)

621.396.615.17 **1335**

Aperiodic Frequency Doubler for a Sinusoidal Electric Quantity.—M. Nuovo. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 330–335. In Italian.) Discussion of a doubler which uses a single valve with two control grids. The doubler can operate at all frequencies for which this valve can amplify. The output is practically free from unwanted harmonics.

621.396.615.18 **1336**

Quasi-Aperiodic Divider for Low Acoustic Frequencies.—E. Gatti. (*Atti del Congresso internazionale della Radio, Rome,* Sept./Oct. 1947, pp. 297–301. In Italian.) A very stable divider has been used for over a year to reduce a standard frequency of 100 kc/s to 1 000 c/s. Associated apparatus to extend the reduction to 50 c/s is discussed. See also 3687 of 1939 (Miller) and 1598 of 1948.

621.396.615.18 **1337**

Synchronous Frequency Division.—P. G. Bordoni. (*Atti del Congresso internazionale della Radio, Rome,* Sept./Oct. 1947, pp. 252–272. In Italian.) By studying mechanical oscillatory systems whose parameters vary periodically, analogous electrical circuits can be realized for frequency halving in which instability is impossible. Practical experience with two different circuits confirms theoretical predictions and shows that considerable voltage amplification and good waveform can be obtained together. Only one triode is needed for each stage of division.

621.396.645 **1338**

Note on the Sensitivity of an Amplifier Stage.—W. Kleen. (*Ann. Radioélect.,* Oct. 1948, Vol. 3, No. 14, pp. 299–301.) Calculation shows that the signal/noise ratio of a grounded-grid circuit is given by the same expression as for a grounded-cathode circuit. For a given valve, therefore, the optimum sensitivities of two such amplifier stages should be the same.

621.396.645 **1339**

The Quasistationary Wave Amplifier.—W. Kleen. (*Elektrotechnik, Berlin,* Dec. 1948, Vol. 2, No. 12, pp. 341–342.) A short discussion of distributed amplification, based on the account given by Ginzton et al. (3375 of 1948).

621.396.645 **1340**

Study of Amplifiers for Square-Wave Signals.—H. Gilloux. (*Radio franç.,* Jan. 1949, No. 1, pp. 6–12.) Methods of producing square-wave signals are briefly considered and the response of an amplifier stage to such signals is discussed with particular reference to circuit time constants. Practical design details are given for RC-coupled and cathode-coupled circuits. Low-frequency and high-frequency compensation methods are outlined and transformer coupling and the use of feedback are discussed. These design principles have been used for amplifiers with outputs of the order of 20 W and 50 W respectively, both having only 0.5% distortion at full power and passing square-wave signals of frequencies from 25 to 15 000 c/s.

621.396.645.029.3 **1341**

A Miniature Audio-Frequency Amplifier.—W. T. Duerdoth & J. Garlick. (*P.O. elect. Engrs' J.,* Jan. 1949, Vol. 41, Part 4, pp. 228–233.) Discussion of the design techniques required for a line amplifier occupying a space of $2\frac{1}{2} \times 2\frac{1}{2} \times 4\frac{1}{2}$ in. More than one feedback path is used.

621.396.645.37 **1342**

Group Transmission Time in Feedback Amplifiers.—G. Schaffstein. (*Frequenz,* Nov. 1948, Vol. 2, No. 11, pp. 291–295.) The variations of phase and group transmission time due to feedback are calculated. With pure positive or negative feedback the phase difference between input and output voltages is constant. The phase variation is greatest when the feedback voltage is 90° out of phase with respect to the input voltage. Variations of the group transmission time occur for both positive and negative feedback and for 90° phase displacement between feedback and input voltages. For pure phase feedback, the transmission-time variation is proportional to k, the ratio of feedback and input voltages, but for 90° phase displacement between feedback and input voltages the variation is proportional to k^2. For a single-stage amplifier the gain and group transmission time vary in the same way. For a multistage amplifier the transmission-time variations for the same gain variation differ according to whether (*a*) each of the n stages has its own feedback, or (*b*) feedback is applied between input and output. In the latter case the variations are n times larger. Experiments with a 2-stage amplifier confirmed the theory.

621.396.645.371 **1343**

Linear Power Amplifiers in American Broadcasting.—W. H. Doherty. (*Atti del Congresso internazionale della Radio, Rome,* Sept./Oct. 1947, pp. 280–291. In English.) Discussion of: (*a*) operating principles and practical adjustment of the Doherty amplifier, (*b*) the application of negative feedback to increase linearity, (*c*) the advantages of this system, particularly for high-power broadcasting transmitters. See also 378 of 1940 (Doherty & Towner).

621.397.645 **1344**

Stagger-Peaked Video Amplifiers.—A. Easton. (*Electronics,* Feb. 1949, Vol. 22, No. 2, pp. 118–120.) The use of stagger tuning to obtain a desired amplitude/frequency characteristic was discussed in 2491 of 1948 (Wallman). A similar general principle is here applied to video amplifiers.

621.3.012 : 621.38.001.8 **1345**

Handbook of Industrial Electronic Circuits. [Book Review]—J. Markus & V. Zeluff. McGraw-Hill, London, 272 pp., 39s. (*Wireless Engr,* Dec. 1948, Vol. 25, No. 303, p. 400.) The book contains circuit diagrams, usually with typical component values and short explanatory notes. The subjects covered include a.f. capacitance control, c.r. control, counters, d.c. amplifiers, electronic switches, limiters, measurement, metal location, motor control, multivibrators, oscillators, photoelectric circuits, power supplies, stroboscopy, telemetry, temperature control, timing, ultrasonics, voltage regulation and welding. Only American work is mentioned.

GENERAL PHYSICS

53.081 + 621.3.081 **1346**

The Rationalized Giorgi System in the Theory of Electricity.—P. Cornelius. (*Tijdschr. ned. Radiogenoot.,* Jan. 1949, Vol. 14, No. 1, pp. 1–9. In Dutch, with English summary.) Reasons are advanced for the adoption of the Giorgi system with the absolute volt and ampere. It enables the relations between electrical quantities and mechanical forces to be expressed in a particularly simple form. Maxwell's laws are presented in rationalized units.

535.215.3 **1347**

The Capacitor Method for Investigations of Photo-E.M.F.—S. M. Ryvkin. (*Zh. tekh. Fiz.,* Dec. 1948, Vol. 18, No. 12, pp. 1521–1542. In Russian.)

535.343.4 : 535.61-15 **1348**

The Infra-Red Spectra of Atmospheric Gases other than Water Vapour.—G. B. B. M. Sutherland & G. S. Callendar. (*Rep. Progr. Phys.,* 1942/1943, Vol. 9, pp. 18–28.)

535.343.4 : 535.61-15 : 546.212 **1349**

The Absorption of Water Vapour [illegible] the Far Infra-Red.—T. G. Cowling. (*Rep. Progr. Phys.,* 1942/1943, Vol. 9, pp. 29–41.)

536.3 **1350**

The Efficiency of Radiation Shields.—A. E. De Barr. (*Rev. sci. Instrum.*, Dec. 1948, Vol. 19, No. 12, p. 922.) Comment on 1022 of April (Garrison & Lawson).

537.122 : 538.3 **1351**

General Properties of the Paraxial Electron-Optic Image.—F. Borgnis. (*Helv. phys. Acta*, 20th Dec. 1948, Vol. 21, No. 6, pp. 461–479. In German.) Discussion, for fields of axial symmetry, based on the differential equation for an electron path near the axis.

537.2 **1352**

Potential and Field of a Plane Electrode with an Elliptical Hole.—M. Cotte. (*C. R. Acad. Sci., Paris*, 31st Jan. 1949, Vol. 228, No. 5, pp. 377–378.) Exact formulae are derived.

537.311.62 **1353**

Calculation of the Magnetic Skin Effect in Steel Sheets taking into account the Relationship between Magnetic Permeability and Magnetic Field Intensity.—S. D. Margolin. (*Zh. tekh. Fiz.*, Oct. 1948, Vol. 18, No. 10, pp. 1306–1316. In Russian.)

537.311.62 **1354**

The Theory of the Anomalous Skin Effect in Metals.—G. E. H. Reuter & E. H. Sondheimer. (*Proc. roy. Soc. A*, 22nd Dec. 1948, Vol. 195, No. 1042, pp. 336–364.) The problem of h.f. metallic conduction is reviewed and exact solutions are obtained which are valid at all frequencies and temperatures. For large values of the free path of the conduction electrons, the electric field is propagated through the metal as a ‘ surface wave ’ which differs considerably from the classical exponential solution. For the temperature variation of the surface impedance in the microwave range, Pippard's simplified theory is qualitatively correct. The frequency variation of the surface impedance at low temperatures is also discussed ; relaxation effects are negligible in the microwave range but become important in the infra-red and eventually restore the validity of the classical theory. Theory predicts that the reflection coefficient of metals should pass through a minimum in the far infra-red. See also 1014 of 1948 (Pippard).

537.312.62 **1355**

Superconductivity.—K. Mendelssohn. (*Rep. Progr. Phys.*, 1944/1945, Vol. 10, pp. 358–375. Bibliography, pp. 375–377.) A general review, with particular reference to Russian and German work.

537.533 : 530.145.6 : 621.385.833 **1356**

Field Emission of Electrons.—R. O. Jenkins. (*Rep. Progr. Phys.*, 1942/1943, Vol. 9, pp. 177–197.) A survey of experimental work begins with that of Lilienfeld and includes the development of the field-emission electron microscope. The application of wave mechanics is discussed.

538.22 **1357**

Modern Theory of Magnetism : Part 2.—S. V. Vonsovski. (*Uspekhi fiz. Nauk*, 1948, Vol. 36, No. 1, pp. 30–82. In Russian.) Discussion of diamagnetic and paramagnetic materials and magnetic cooling.

538.3 **1358**

The Field of a Point Source of Current located on the Surface of the Earth above an Inclined Layer.—I. P. Skal'skaya. (*Zh. tekh. Fiz.*, Oct. 1948, Vol. 18, No. 10, pp. 1242–1254. In Russian.)

538.3 **1359**

Classical Electrodynamics without Singularities.—H. McManus. (*Proc. roy. Soc. A*, 22nd Dec. 1948, Vol. 195, No. 1042, pp. 323–336.) It is possible to construct a theory of the electron with an extended charge distribution in a Lorenz invariant way by introducing a 4-dimensional form function. E.m. field quantities reduce to those given by the ordinary theory at distances large compared with the electron radius, but remain finite on the world line. See also 698 of 1948 (Eliezer).

538.6 : 537.525 **1360**

The Influence of a Transverse Magnetic Field on a Cylindrical Plasma.—L. Beckman. (*Proc. phys. Soc.*, 1st Dec. 1948, Vol. 61, No. 348, pp. 515–520.)

621.39.001.11 **1361**

A Mathematical Theory of Communication.—C. E. Shannon. (*Bell Syst. tech. J.*, July & Oct. 1948, Vol. 27, Nos. 3 & 4, pp. 379–423 & 623–656.) The methods of statistical mechanics are applied to determine rates for the efficient transmission of information in generalized coded forms. The properties of discrete and continuous sources and the effect of noise are considered. Entropy of the source and capacity of the channel are defined, and it is shown that statistical matching of channel to source is required. By suitable choice of coding, errors in transmission may be made as small as desired, provided the rate does not exceed the channel capacity. For a continuous source, the maximum rate is expressed in terms of a measure of required fidelity.

621.396.822 **1362**

The Energy of Electrical Fluctuations in Conductors.—E. Ya. Pumper. (*Zh. eksp. teor. Fiz.*, Dec. 1948, Vol. 18, No. 12, pp. 1112–1129. In Russian.) The limitations of Nyquist's formula (p. 1112) determining the thermal effect are discussed. Experiments were designed to determine the distribution of probabilities of electrical fluctuations in conductors at frequencies from 4 kc/s to 136 kc/s, and for the absolute measurement of fluctuational energy. The main conclusions reached are: (*a*) In many thin metallic and graphite conductors the noise level exceeds the value calculated from the thermal effect theory; the discrepancy increases with the frequency. (*b*) Experiments with an electrolyte (a weak solution of KCl) and annealed resistances have shown that other variations, besides those due to thermal effect, occur more rarely and disturb the distribution of probabilities. (*c*) Experiments with heated resistances have shown that additional fluctuations can be eliminated by rapid annealing. (*d*) There are reasons to suppose that the excess of the fluctuation level over the theoretical value is due to emission of energy from the crystal lattice and is related to the process of crystallization.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

522.56 : 523.7 **1363**

Physical Basis of Solar Research and Technical Aids.—V. von Keussler. (*Z. angew. Phys.*, Nov. 1948, Vol. 1, No. 5, pp. 232–242.) A review, for the last 20 years, of research methods and apparatus for optical wavelengths. 72 references are included.

523.53 : 551.510.535 **1364**

The Exploratory Properties of Radio Waves and Their Application to the Detection of Meteor Trails.—R. Naismith. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 160–167. In English.) The transient echoes observed near the sporadic-E region are due to reflections from the ionization trails of meteors. There is a marked seasonal variation in the number of meteors recorded around noon. The response of the medium also has a seasonal variation. In temperate latitudes, sporadic-E ionization is mainly due to the fine dust of meteors. The atmosphere is continually being bombarded with meteoric dust particles, most of which are too small to produce visible meteor trails.

523.53 : 621.396.9 **1365**
The Theory of the Radio Detection of Meteors.—Manning. (*See* 1392.)

523.72 : 523.854 **1366**
The Radio Spectrum of the Sun and of the Milky Way.—C. E. Krüger. (*Atti del Congresso internazionale della Radio, Rome,* Sept./Oct. 1947, pp. 133–140. In Italian.) Discussion and theoretical interpretation of results obtained by various authors. See also 1028 of 1945 (Reber) and 3270 of 1946 (Hey, Phillips & Parsons).

523.72 + 523.854] : 621.396.822 **1367**
Radio Astronomy.—C. R. Burrows. (*Electronics,* Feb. 1949, Vol. 22, No. 2, pp. 75–79.) A general review of knowledge obtained from solar and galactic r.f. radiation measurements, and of possible future developments.

523.72.029.62 **1368**
Some Characteristics of Solar Radio Emissions.—J. S. Hey, S. J. Parsons & J. W. Phillips. (*Mon. Not. R. astr. Soc.,* 1948, Vol. 108, No. 5, pp. 354–371.) Continuation of experimental investigations noted in 1825 of 1946 (Hey) and 3508 of 1947 (Appleton & Hey). Discussion of the relation between solar radio emissions observed mainly at $\lambda = 4.1$ m between March 1946 and Sept. 1947, and associated visual solar and geophysical phenomena. The most intense flares are the most likely to produce radio bursts; in general the radio emission lags several minutes behind the visual or ultra-violet flare radiations. The heliographic distribution of coincidences between flares and bursts is considered and contrasted with the sharply-beamed pattern of continuous radiation associated with sunspots.

523.745 : 550.385/.386 **1369**
Geomagnetic Disturbances and Solar Activity.—A. I. Ol'. (*Priroda,* July 1948, No. 7, pp. 3–10. In Russian.) Discussion of corpuscular solar radiation and its connection with disturbances of the earth's magnetic field, with special reference to the solid angle of the radiation, the M-regions in the sun which emit the radiation, observations of the absorption lines of ionized Ca in the solar spectrum during magnetic storms, and the two types of corpuscular radiation thought to cause the two classes of magnetic storms.

523.746 : 550.38 **1370**
Observational Aspects of the Sunspot-Geomagnetic Storm Relationships.—H. W. Newton. (*Mon. Not. R. astr. Soc.,* 1948, Vol. 108, No. 5, p. 423.) Summary only. Using international magnetic character figures, the statistical rise of geomagnetic activity is investigated for the solar disk passage of four area groupings of sunspots, between 1914 and 1944. For large sunspots there is an increase of geomagnetic activity centred at about 2 days after the central meridian passage of the sunspots. For smaller sunspots, groupings based on solar flare incidence are better correlated with geomagnetic activity than those based on area. 27-day recurrence tendencies of geomagnetic activity are not well defined except in the case of the smaller storms, especially those without associated sudden commencements, sunspots or solar flares. The statistical non-recurrence of great magnetic storms is confirmed.

523.746 " 1941 " **1371**
Mean Areas and Heliographic Latitudes of Sunspots in the Year 1941.—(*Mon. Not. R. astr. Soc.,* 1948, Vol. 108, No. 5, pp. 420–422.)

523.746.5 **1372**
Double Cycle of Solar Activity.—A.I. Ol'. (*Priroda,* Aug. 1948, No. 8, pp. 39–41. In Russian.) Additional confirmation of the existence of the 22-year cycle of solar activity suggested by M. N. Gnevyshev & A. I. Ol' (*Astronomicheski Zhurnal,* 1948, Vol. 25, No. 1).

523.76 **1373**
Solar Physics.—A. Hunter. (*Rep. Progr. Phys.,* 1942/1943, Vol. 9, pp. 101–112.)

538.12 : 521.15 **1374**
Magnetic Field of Massive Rotating Bodies.—Yu. G. Pliner. (*Priroda,* July 1948, No. 7, pp. 16–24. In Russian.) The implications of Blackett's theory (3112 of 1947) are discussed and the following three methods of its verification are considered in turn: (*a*) application of the theory to stars, (*b*) extension of the theory to rotating bodies on the earth, and (*c*) extension of the theory to elementary particles such as Bohr's magneton. The possibility is suggested that the magnetic field of the moon could be measured by means of rockets which would overcome the force of gravity of the earth and be attracted by the moon while sending radio messages back to the earth. Experiments conducted by P. N. Lebedev in 1909 are mentioned in connection with (*b*).

551.5 : 621.396 **1375**
Applications of Radio in Modern Meteorology.—R. Bureau. (*Atti del Congresso internazionale della Radio, Rome,* Sept./Oct. 1947, pp. 683–695. In French.) Various radio techniques have combined to increase enormously the quality and quantity of information available for the forecaster.

551.51 : 541.14 **1376**
Photochemical Processes in an Oxygen-Nitrogen Atmosphere.—C. H. Bamford. (*Rep. Progr. Phys.,* 1942/1943, Vol. 9, pp. 75–89. Bibliography, pp. 89–91.)

551.51 : 541.14 : 546.21 **1377**
The Photochemistry of Atmospheric Oxygen.—S. Chapman. (*Rep. Progr. Phys.,* 1942/1943, Vol. 9, pp. 92–100.) An outline of the attempts made to account for the existence of ozone and atomic oxygen. The diurnal and seasonal changes in the ozone content of the atmosphere are discussed.

551.510.5 : 537.56 **1378**
Ionization Phenomena in the Earth's Atmosphere.—J. Sayers. (*Rep. Progr. Phys.,* 1942/1943, Vol. 9, pp. 52–61.) For the first 20 km above sea level the ionization balance is simple and measurements of conductivity confirm the theoretical values. The balance equations for free electrons and for ions in the ionosphere are developed. The effective recombination coefficients for the E and F regions are discussed and compared with values deduced from radio observations.

551.510.5 : 546.21 **1379**
The Properties of Neutral and Ionized Atomic Oxygen and their Influence on the Upper Atmosphere.—H. S. W. Massey & D. R. Bates. (*Rep. Progr. Phys.,* 1942/1943, Vol. 9, pp. 62–74.) The energy levels of positive and negative ions and neutral atoms of oxygen are briefly considered and the probabilities of various ionization,

recombination, and attachment processes are discussed. In the ionosphere the observed recombination coefficients are too large to be accounted for by direct radiative recombination of electrons and ions; the presence of negative ions must be assumed.

551.510.535 **1380**

The Present State of Investigations of the Ionosphere: Part 2.—Ya. L. Al'pert. (*Uspekhi fiz. Nauk*, 1948, Vol. 36, No. 1, pp. 1–29. In Russian.) The formation of ionized layers and the processes taking place in them are discussed.

551.510.535 **1381**

The Analysis of Ionospheric Reflections: Part 1.—A. H. de Voogt. (*Tijdschr. ned. Radiogenoot.*, Nov. 1948, Vol. 13, No. 6, pp. 183–195. In English. Corrections, *ibid.*, Jan. 1949, Vol. 14, No. 1, insert.) Formulae for the complex refractive index and polarization are based on the Appleton-Hartree formula; curves are given representing the results of careful calculations, by the mathematical bureau of the Dutch Post Office, of refractive index, group velocity, attenuation and polarization for a frequency of 6 Mc/s, assuming conditions similar to those over the Netherlands. Experiments to verify these results will be described in part 2.

551.510.535 : 525.624 **1382**

The Lunar Atmospheric Tide at Twenty-Seven Stations Widely Distributed over the Globe.—S. Chapman & K. K. Tschu. (*Proc. roy. Soc. A*, 22nd Dec. 1948, Vol. 195, No. 1042, pp. 310–323.) The tides were determined by the Chapman-Miller method from bi-hourly values of barometric pressure covering periods of 5 years or more at each station. Results are discussed.

551.510.535 : 621.317.79 **1383**

Ionosphere Reflections Recorded Mechanically by means of a Repetition Frequency Converter.—Stoffregen. (*See* 1438.)

551.510.535 : 621.396.11 **1384**

Regular Ionosphere Observations over Mid-Germany.—Dieminger. (*See* 1475.)

551.510.535 : 621.396.11 **1385**

Ionosphere Review: 1948.—T. W. Bennington. (*Wireless World*, Feb. 1949, Vol. 55, No. 2, pp. 56–60.) A survey of sunspot and s.w. propagation conditions for 1948, with forecast for 1949.

551.593.9 **1386**

The Spectrum of the Night Sky.—R. W. B. Pearse. (*Rep. Progr. Phys.*, 1942/1943, Vol. 9, pp. 42–51.)

551.593.9 **1387**

Variations of the Colour of the Night Sky from March 1947 to May 1948.—R. Grandmontagne & C. Delestrade. (*C. R. Acad. Sci., Paris*, 31st Jan. 1949, Vol. 228, No. 5, pp. 415–416.) Results obtained with a photoelectric recorder at the Haute-Provence observatory are tabulated and discussed.

551.594 **1388**

Electric Field Intensity Inside of Natural Clouds.—R. Gunn. (*J. appl. Phys.*, May 1948, Vol. 19, No. 5, pp. 481–484.) Maximum intensities measured by instruments carried on aircraft flying through the clouds were of the order of 3 kV/cm. This is much higher than previous values based on free-balloon soundings. See also 2425 of 1947.

551.594.21 **1389**

Propagation of Atmospherics.—H. Norinder. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 168–195. In English.) Discussion of initial results of a projected long-term investigation. Two mobile stations and a fixed station near Uppsala (Sweden) were almost in line, with intervals of 27 and 37 km. Numerous oscillograms of the received electric field are shown; a striking feature is a change of polarity beyond a certain distance, which may partly be due to reflection from ionized layers at a great height in the thunderstorm. Simultaneous observations of atmospherics at two fixed stations 200 km apart are also discussed; the importance of direction finders at these stations is emphasized. See also 3907 of 1947 and back references.

551.594.21 : 621.396.11 **1390**

Guided Propagation of Radar in Thunderstorm Conditions.— Coons. (*See* 1478.)

551.594.221 **1391**

The Lightning Discharge.—J. M. Meek & F. R. Perry. (*Rep. Progr. Phys.*, 1944/1945, Vol. 10, pp. 314–354. Bibliography, pp. 354–357.) The formation of thunderclouds and the mechanism of the lightning discharge are discussed from the theoretical aspect and accounts of experiments using a Boys' camera are given. The technique of the measurement of the current and voltage of a discharge is considered generally. An electrometer to measure atmospheric voltage gradients is described and results obtained with it are given. Future work is discussed.

LOCATION AND AIDS TO NAVIGATION

621.396.9 : 523.53 **1392**

The Theory of the Radio Detection of Meteors.—L. A. Manning. (*J. appl. Phys.*, Aug. 1948, Vol. 19, No. 8, pp. 689–699.) Methods of observation for both bursts of signal strength and whistles caused by reflection of radio waves from meteoric ionization are discussed. Meteor velocity and range can be accurately determined by combined burst and whistle observations. The possibility of determining the direction and position of a meteor path by observations at 3 receiving stations is examined. The percentage of meteors capable of producing bursts depends on the angle between the meteor path and the vertical and on the direction from which signals are received; various possible formulae for it are discussed.

621.396.93 **1393**

Recent Progress in Radio Direction Finding.—R. L. Smith-Rose. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 877–901. In English.) A detailed survey of methods used in the frequency range 10 kc/s–1 200 Mc/s. Aerial systems, recent advances in instrumental technique and calibration, accuracy limitations, and the effect of the ionosphere on the accuracy of bearings are discussed. Methods of d.f. transmission include the rotating-loop beacon, the equi-signal beacon and the Consol system. Future trends in h.f. d.f. include the use of highly directional receiving systems for the reduction of site errors, more accurate transfer of angular data from the direction finder to the plotting centre, and methods to enable the operator to assess the approximate bearing accuracy.

621.396.93 **1394**

Automatic Direction-Finder.—J. R. Steinhoff. (*Electronics*, Feb. 1949, Vol. 22, No. 2, pp. 97–99.) A lightweight and compact instrument having bearing accuracy within 1°. The externally mounted loop assembly is stationary and hermetically sealed; it consists of 4 coils arranged as two pairs at right angles. A special switching system enables each coil voltage to be sampled in succession 50 times a second and transmitted to the corresponding coil of the indicating meter, which is calibrated in degrees. Block and circuit diagrams are included.

621.396.93 **1395**

The Interconnection of Dead-Reckoning and Radar Data for Precision Navigation and Prediction.—B. Chance. (*J. Franklin Inst.*, Nov. 1946, Vol. 242, No. 5, pp. 355–372.) The importance of accurate dead-reckoning data for both ship and aircraft navigation is stressed. Methods of providing an index on a radar display which continuously indicates the dead-reckoning position of an identifiable object are discussed. The solution of problems involving the relative motion of two ships, wind velocity, or ground range in aerial navigation can thus be greatly simplified. See also 1396 below.

621.396.93 **1396**

G.P.I. [ground position indicator] **— An Automatic Navigational Computer.**—W. J. Tull & N. W. MacLean. (*J. Franklin Inst.*, Nov. 1946, Vol. 242, No. 5, pp. 373–398.) A device indicating continuously the present position on the earth's surface of the ship or aircraft in which it is carried. Wind velocity and velocity relative to the ground are determined from data provided by a true airspeed meter and the radar and compass. The total distance travelled is presented numerically, and the heading required in order that a particular course may be followed is also indicated. The computing mechanism used is described in detail and its operation is explained. The main types of error due to the instruments which supply the g.p.i. with data are discussed. Applications are considered. See also 1395 above.

621.396.93 : 621.396.67 **1397**

An Investigation of Resonances and Asymmetry in the Adcock Aerial Systems.—Fradin & Khatskelevich. (*See* 1293.)

621.396.932 **1398**

Radar for Tilbury-Gravesend Ferry.—(*Engineer, Lond.*, 10th Dec. 1948, Vol. 186, No. 4846, p. 595.) Scanner unit 80 ft above ground; frequency 9 425–9 525 Mc/s; output power 30 kW; pulse width 0.2 μs and repetition rate 2 000 pulses/sec; 2-way R/T communication between the radar operators and the masters of the ferries; p.p.i. display with ranges of 0.8, 1.2 or 3 miles.

621.396.933 **1399**

Review of Recent Trends in Radio Aids to Air Navigation.—H. Busignies, P. R. Adams & R. I. Colin. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 696–716. In English.) A comprehensive account of basic principles and development work, with a brief description of various existing systems. International recommendations are summarized.

621.396.933 **1400**

Aerial Radio Navigation in Wartime.—Guigonis. (*Onde élect.*, Jan. 1949, Vol. 29, No. 262, pp. 21–25.)

621.396.933 **1401**

Decca Navigator System of Hyperbolic Navigation.—P. Giroud & L. Couillard. (*Onde élect.*, Jan. 1949, Vol. 29, No. 262, pp. 5–20.) A detailed discussion of basic principles, method of operation, practical equipment and applications.

621.396.933.2 **1402**

High-Stability Radio Distance-Measuring Equipment for Aerial Navigation.—H. Busignies. (*Elect. Commun.*, Sept. 1948, Vol. 25, No. 3, pp. 237–243.) A performance specification with brief technical description of a 51-channel interrogator-responder system. Challenging and responding frequencies, which are crystal controlled, are separated by 125.5 Mc/s; both are in the aerial-navigation band of 960–1 215 Mc/s. Adjacent channels may be used by different beacons, and one beacon can deal with up to 50 aircraft. Distances up to 100 nautical miles are indicated on a meter with an accuracy within ±0.2 miles or 1%, whichever is the greater.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 **1403**

On High-Vacuum Technique.—G. W. Oetjen. (*Elektrotechnik, Berlin*, Dec. 1948, Vol. 2, No. 12, pp. 333–340.) A review of modern methods and equipment, with particular reference to pumping rates, the different oils used in oil diffusion pumps, high-vacuum valves, gauges, etc.

535.37 **1404**

The Relation between Efficiency and Exciting Intensity for Zinc-Sulfide Phosphors.—H. A. Klasens, W. Ramsden & Chow Quantie. (*J. opt. Soc. Amer.*, July 1948, Vol. 38, No. 7, p. 649.) Corrections to 3422 of 1948.

535.37 : 621.385.832 **1405**

Silicate Phosphors for Cathode Ray Tubes.—P. N. Campbell. (*J. Soc. chem. Ind., Lond.*, June 1947, Vol. 66, No. 6, pp. 191–194.) The object of the experimental work described was to produce a phosphor which would give a white screen suitable for television. A mixture of powders to produce the correct colour has been found but the brilliance is not yet satisfactory. Possible future developments are indicated. 'Settling' is thought to be the most effective and economical method of preparing screens on a large scale.

537.228.1 **1406**

Recent Progress in Piezoelectric Technique.—A. Tournier. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 485–518. In French.) An illustrated account of the production of quartz crystals from silica at the Laboratoire Central de Télécommunications. Crystallization of other salts can be accelerated by rotation of the crystal during formation and by addition of crystal impurities. Piezoelectric characteristics of rochelle salt and other crystals are discussed in detail. Certain phosphates and arsenates of ammonium or potassium can be used to obtain directly a bandwidth of 4 kc/s at a carrier frequency of 80 kc/s, but they have a large characteristic impedance and temperature coefficient of frequency. See also 2811 of 1948.

538.13 + 538.221 **1407**

The Magnetic After-Effect of Different Types of Silicon-Iron.—H. Wilde & G. Bosse. (*Frequenz*, Aug. 1948, Vol. 2, No. 8, pp. 214–215.) The effect of temperature and of frequency on the complex permeability of three grades of material, containing respectively 4%, 3.5% and 2.5% Si, is shown graphically. Curves are also given for the permeability for various a.c. fields.

538.221 **1408**

Some New Ferromagnetic Manganese Alloys.—F. A. Hames & D. S. Eppelsheimer. (*Nature, Lond.*, 18th Dec. 1948, Vol. 162, No. 4129, p. 968.) The results of an investigation on three Cu-Mn-Ga alloys are given. Two specimens were strongly magnetic when quenched from 750°C. X-ray diffraction data are tabulated, but cannot as yet be satisfactorily interpreted.

538.221 : 538.213 **1409**

Ferro-Magnetics at Ultra-High-Frequencies.—M. J. O. Strutt. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 448–459. Bibliography, pp. 459–462. In English.) It seems probable that in the range of very low frequencies (from zero to a few kc/s) the effective permeability declines from several thousand to several hundred for certain very pure ferromagnetic materials. Anomalies found by some experimenters near 3 Mc/s are believed to be spurious. At room temperatures a marked decline from several hundred to about unity occurs in the frequency range 300–30 000 Mc/s;

it is suggested that the increased conductivity at low temperatures would have the same effect as a corresponding increase of frequency. Even slight differences in treatment of a well-defined material may result in large differences in measured permeability values; hence the entire range 0–30 000 Mc/s should be investigated in one laboratory. A theoretical explanation of the fall in permeability is given in terms of eddy-current effects.

538.244 **1410**

Magnetization in Perpendicularly Superposed Direct and Alternating Fields.—F. J. Beck & J. M. Kelly. (*J. appl. Phys.*, June 1948, Vol. 19, No. 6, pp. 551–562.) General investigation of the behaviour of an iron specimen. Curves of the dynamic longitudinal magnetic induction *vs* transverse magnetic field intensity and transverse magnetic induction are included.

621.315.59 **1411**

Properties of Poorly Conducting Layers between Metals and Semiconductors.—V. E. Lashkarev. (*Zh. tekh. Fiz.*, Nov. 1948, Vol. 18, No. 11, pp. 1347–1355. In Russian.)

621.315.59 : 621.314.63 **1412**

Rectification at the Boundary of Two Semiconductors.—A. V. Ioffe. (*Zh. tekh. Fiz.*, Dec. 1948, Vol. 18, No. 12, pp. 1498–1510. In Russian.) A detailed report upon an experimental investigation. For rectification the two semiconductors in contact must have different types of conductivity and there must be a difference of contact potentials. The hole contact potential should be higher than the electron potential. The following processes are also of importance in rectification: (*a*) the formation of barrier layers of low conductivity, (*b*) variations in their thickness during the passage of the current, (*c*) increase in the conductivity of semiconductors under the influence of the electric field, and (*d*) transfer of charges through the boundaries of the semiconductors.

621.315.612 **1413**

New Ceramic Materials with Very High Dielectric Constant.—A. Pascucci & H. Wolf-Stawski. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 336–363. In Italian.) The work of various authors is reviewed and an experimental investigation into the relationship between dielectric constant and loss angle for materials containing titanates of Ba and Sr is described. Applications are discussed.

621.315.612.011.5 **1414**

Variation of the Dielectric Properties of Ceramic Materials with Magnesium-Orthotitanate Base and its Representation by the Logarithmic Law of Mixtures.—E. Albers-Schoenberg & W. Soyck. (*Ann. Radioélect.*, Oct. 1948, Vol. 3, No. 14, pp. 290–292.) Results for materials containing titanates of Mg and Ca or Sr show the logarithmic law to hold for the dielectric constant, which increases from about 20 for 7% of $CaTiO_3$ to 120 for 85% of $CaTiO_3$, the corresponding temperature coefficients being -10×10^{-6} per °C and $-1\,600 \times 10^{-6}$ per °C.

621.318.2 **1415**

Permanent Magnets.—W. E. Burnand. (*Elect. Rev., Lond.*, 14th Jan. 1949, Vol. 144, No. 3712, pp. 63–67.) Discussion of economical methods of magnetization for magnets of awkward shapes.

621.318.22 **1416**

Materials for Permanent Magnets.—S. Wintergerst. (*Funk u. Ton*, Jan. 1949, Vol. 3, No. 1, pp. 48–50.) The composition and some magnetic and physical properties of 12 alloys are tabulated and discussed.

621.318.22 **1417**

Magnetic Materials: a Review of Progress.—F. Brailsford: D. A. Oliver & D. Hadfield: G. R. Polgreen. (*J. Instn elect. Engrs*, Part I, Dec. 1948, Vol. 95, No. 96, pp. 522–543.) Part 1: Electrical sheet steels. Part 2: Permanent-magnet materials. Part 3: Magnetic powder cores.

621.775.7 : 538.221 **1418**

Verification of Néel's Theory for the Coercive Field of Finely Powdered Ferronickel Alloys.—L. Weil. (*C. R. Acad. Sci., Paris*, 20th Dec. 1948, Vol. 227, No. 25, pp. 1347–1349.) Measurements on alloys containing 50–90% Ni confirm that the mean coercive field for agglomerated powders with little or no magnetic anisotropy is directly proportional to the magnetization at saturation. See also 3151 and 3152 of 1947 (Néel).

666.1.037.5 **1419**

The Theory of Stresses in Two-Component Glass to Metal Tube Seals.—H. Rawson. (*J. sci. Instrum.*, Jan. 1949, Vol. 26, No. 1, pp. 25–27.) Theory based on that of Lamé is given, with curves showing the dependence of the principal stresses at the seal interface on the seal dimensions.

666.192.037.5 **1420**

New Quartz-Metal Seal.—E. H. Nelson. (*Elect. Rev., Lond.*, 14th Jan. 1949, Vol. 144, No. 3712, pp. 60–62.) The metal part of the seal consists of a Mo annulus of lenticular cross-section soldered coaxially upon a Mo rod. The rod provides a large current-carrying capacity whilst the annulus gives a hermetic seal.

679.5 : 535.316/.317 : 534.321.9 **1421**

Ultrasonic Lenses of Plastic Materials.—D. Sette. (*J. acoust. Soc. Amer.*, Jan. 1949, Vol. 21, No. 1, p. 61.) Summary of Acoustical Society of America paper. Propagation velocity and attenuation of elastic waves have been measured in various synthetic materials; plexiglas appears to be the most suitable material for such lenses.

MATHEMATICS

517.53 : 621.392.52 **1422**

Splitting of an Analytical Function into a Linear and a Nonlinear Part, and also a Method of Determining, for a Known Linear Component, the Nonlinear Component and the Function as a Whole.—H. Pleijel. (*Arch. elekt. Übertragung*, Aug./Nov. 1948, Vol. 2, No. 8, pp. 307–320.) Mathematical discussion. In many cases the problem has a simple solution. Applications to the theory of filter networks are considered.

517.942 : 621.396.611.3 **1423**

On Linear Differential Equations with Slowly Variable Coefficients. Application to the Study of Nonlinear Coupling.—C. Blanc. (*Bull. tech. Suisse romande*, 17th July & 14th Aug. 1948, Vol. 74, Nos. 15 & 17, pp. 185–188 & 209–213.) For an equation with slowly variable coefficients and such that the integrals of the equation with the right hand side replaced by zero tend sufficiently rapidly towards zero when the independent variable increases indefinitely, a solution is obtained involving a function which plays the part of a variable admittance. This result is applied to discussion of the maintenance of the oscillations of a pendulum by a.c. and also to the case of two circuits coupled by the variable capacitance between two plates linked elastically.

517.942.1 : 518.5 **1424**

Electro-Integrator for the Solution of the General Linear Differential Equation with Constant Coefficients.—N. V. Korol'kov & G. K. Kuz'minok. (*Bull. Acad. Sci. U.R.S.S. tech. Sci.*, April 1948, No. 4, pp. 517–532. In Russian.) The device described solves systems of such differential equations with a speed determined only by the duration of the transient process in the circuit; any relevant dynamic conditions can be simulated. The integrator is based on a circuit proposed by L. I. Gutenmacher and consisting of a number of interconnected two-terminal and four-terminal networks (valve amplifiers). The solution obtained is shown on a c.r.o. or a loop (mechanical) oscillograph and can be photographed. The operation of the integrator is discussed in detail. A year's experience has proved its suitability for many kinds of research work.

518.5 **1425**

A Discussion on [general-purpose, automatic, digital] **Computing Machines.**—(*Proc. roy. Soc. A*, 22nd Dec. 1948, Vol. 195, No. 1042, pp. 265–287.) The following papers were read: A Historical Survey of Digital Computing Machines, by D. R. Hartree. General Principles of the Design of All-Purpose Computing Machines, by M. H. A. Newman. The Design of a Practical High-Speed Computing Machine, the EDSAC, by M. V. Wilkes. A Cathode-Ray Tube Digit Store, by F. C. Williams. The Automatic Computing Engine at the National Physical Laboratory, by J. H. Wilkinson. Recent Computer Projects, by A. D. Booth. See also 1157 and 1493 of 1947, 464 and 3448 of 1948, 759 of March and 1110 of April.

517.432.1 **1426**

Modern Operational Calculus, with Applications in Technical Mathematics. [Book Review]—N. W. McLachlan. Macmillan, London, 1948, 218 pp., 21s. (*Nature, Lond.*, 18th Dec. 1948, Vol. 162, No. 4129, p. 945.) Based on a transform simply related to that of Laplace. The book is intended for post-graduate engineers and technologists and is unusually rigorous.

MEASUREMENTS AND TEST GEAR

531.761 + 621.317.361 **1427**

Limits for the Comparison of Frequency and Time at Great Distances.—M. Boella. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 213–224. In Italian.) A series of measurements on the stability of standard signals received from the Bureau of Standards confirms that irregular variations up to ±2 parts in 10^7 exist and are due to a propagation effect; their magnitude depends on the time of day. The afternoon is the best time for precise comparisons at 15 Mc/s; the maximum errors then observed are 2 parts in 10^8. See also 1163 of April (Rawer) and back reference.

531.761 **1428**

High-Precision Comparison of Times.—C. Egidi. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 292–296. In Italian.) Discussion of apparatus specially designed for comparing WWV with other standard signals.

621.317.3 **1429**

An Experimental Method for Determining the Fundamentals and Harmonics of Stationary Low-Frequency Electrical Quantities.—F. Koppelmann. (*Frequenz*, Nov. 1948, Vol. 2, No. 11, pp. 296–303.) A moving-coil instrument is used with a mechanical rectifier (synchronized with the supply voltage) and suitably connected resistors to obtain the integral curve of the quantity in question. The values of the fundamental and harmonics are then calculated from measurements of selected ordinates. The method is illustrated by results for a transformer core.

621.317.324† **1430**

Production of a Uniform H.F. Field for Measurement Purposes.—E. Roeschen. (*Funk u. Ton*, Jan. 1949, Vol. 3, No. 1, pp. 18–32.) Sensitive methods of field-strength measurement are based on measurements of mutual inductance. Curves are given showing the field strength for single circular coils and for combinations of pairs of coils. For a particular 4-coil system the deviations from uniformity of the field were $< 1\%$.

621.317.335.3† + 621.317.374 **1431**

Determination of Dielectric Quantities by Balance Methods.—T. Gast & E. Alpers. (*Z. angew. Phys.*, Nov. 1948, Vol. 1, No. 5, pp. 228–232.) The basic principles of the methods are outlined and the apparatus used is described. Typical results are given showing the dependence of the dielectric constant and loss factor of polyvinyl chloride on temperature and frequency.

621.317.335.3† : 546-145 **1432**

On the Measurement of the Dielectric Constant of Solutions at High Frequencies.—U. Tiberio. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 463–484. In Italian.)

621.317.335.3† : 621.392.26† **1433**

Universal Curves for Dielectric-Filled Wave Guides and Microwave Dielectric Measurement Methods for Liquids.—W. H. Surber, Jr. (*J. appl. Phys.*, June 1948, Vol. 19, No. 6, pp. 514–523.) A method is given for constructing a set of curves for the variation of waveguide parameters in terms of D, a dissipation factor of the dielectric filling analogous to tan δ for coaxial lines. An experimental method is described for measuring the dielectric constant ϵ of a high-loss liquid contained in a waveguide, from the variation of reflection coefficient with sample length. The constants of the medium can then be determined using ϵ and D as primary independent parameters.

621.317.335.3† : 621.396.611.4 **1434**

A Method for Measuring the Complex Dielectric Constant of Gases at Microwave Frequencies by using a Resonant Cavity.—C. K. Jen. (*J. appl. Phys.*, July 1948, Vol. 19, No. 7, pp. 649–653.) For low-pressure gases at X-band frequencies (8 500–9 750 Mc/s). The real part of the dielectric constant of a gas affects the natural frequency of a resonant cavity containing it while the imaginary part affects the amplitude and breadth of the cavity response curve. By rapid variation of the frequency through resonance, the real and imaginary parts can be conveniently and accurately determined from c.r.o. measurements. Sample results are given. The method can also be used for the measurement of (*a*) the resonant dispersion and absorption of microwaves by gas molecules, and (*b*) the loaded and unloaded Q of a cavity.

621.317.725 : 621.317.733 **1435**

Analysis of Bridge-Type Valve Voltmeters.—P. Popper & G. White. (*Wireless Engr*, Dec. 1948, Vol. 25, No. 303, pp. 377–384.) Two arms of the bridge are formed by the valve and its associated resistors. The other two can be formed either by two resistors or by a similar valve and a resistor. These two types of bridge can be further subdivided according as the valve resistor is placed in the anode or cathode circuit. The relative merits of these four types are compared from the points of view of sensitivity, stability, linearity, and the effect of choice of output meter upon performance. For a single-valve circuit (with positive biasing battery) the transfer of the resistor from the anode to the cathode lead improves stability and linearity, but with the two-valve circuit this is not the case. A graphical solution for nonlinear operation in the two-valve circuit is given. Optimum deflection sensitivity occurs when the meter resistance equals the output resistance of the circuit; this cannot be realized in practice when anode resistors are used in double-valve circuits.

621.317.727 **1436**

An A.C. Potentiometer.—J. M. Vanderleck. (*Elect. Engng, N.Y.*, Feb. 1948, Vol. 67, No. 2, pp. 173–181.) Description of an instrument of the Gall type for general measurements. Simplicity of operation rather than absolute accuracy was the primary consideration.

621.317.761 : 621.396.611.4 **1437**

Electrical Measurements on Transmission Cavity Resonators at 3 cm Wavelength.—M. S. Wheeler. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 520–525. In English.) Energy from a 3-cm f.m. oscillator is applied, through a variable attenuator and the cavity under test, to a rectifier crystal which provides, after amplification, the voltage for the vertical deflection of a c.r.o. beam. A small part of the oscillator energy is transmitted through a high impedance to another crystal, to which a standard frequency is also applied. The difference-frequency voltage intensifies the trace on the c.r. screen whenever the difference frequency falls within the pass band of the Z-axis amplifier. The horizontal sweep is derived from the oscillator modulating voltage, so that a response/frequency curve is produced with bright spots superimposed and spaced equally on either side of the reference frequency. Accuracy of measurement of the resonance frequency is estimated as within 1 part in 150 000.

621.317.79 : 551.510.535 **1438**

Ionosphere Reflections Recorded Mechanically by means of a Repetition Frequency Converter.—W. Stoffregen. (*J. appl. Phys.*, May 1948, Vol. 19, No. 5, pp. 487–490.) The high repetition frequency (50 c/s) of received ionospheric echoes is converted to a much lower frequency (0.2–0.5 c/s) by a stroboscopic technique. Mechanical recording of echoes having a delay of some milliseconds, using a pulse width of 20–100 μs, is thus facilitated. See also 789 of March.

621.319.4(083.74) **1439**

Standards for Low Values of Direct Capacitance.—C. Moon & C. M. Sparks. (*Bur. Stand. J. Res.*, Nov. 1948, Vol. 41, No. 5, pp. 497–507.) Discussion of the design and measurement of capacitors from 0.001 pF to 5 pF. Capacitors above 0.1 pF are of normal guard-ring type, but below this value a guard-well construction is used.

621.38/.39].001.4 **1440**

Transients in Mechanical Systems.—J. T. Muller. (*Bell Syst. tech. J.*, Oct. 1948, Vol. 27, No. 4, pp. 657–683.) High-impact shock tests for electronic apparatus are analysed by the Laplace transform for various types of impact pulse. Curves for the transient displacement and the maximum amplitude of the ensuing harmonic motion are given.

621.397.62.001.4 **1441**

Airline TV Receiver Installation Tests.—W. S. Smoot. (*Communications*, Jan. 1949, Vol. 29, No. 1, pp. 8–9, 34.) A 12-in. direct-viewing receiver was used, with alternative aerials above and below the aircraft. Power was supplied by means of an inverter. Performance on a run from Washington to Norfolk, Virginia, is discussed.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

534.001.8 **1442**

Generation of Sonic and Ultrasonic Waves in Liquids for Industrial Purposes.—W. Janovsky & R. Pohlman. (*Z. angew. Phys.*, Nov. 1948, Vol. 1, No. 5, pp. 222–228.) A special type of high-frequency whistle is described which gives frequencies from 4 kc/s to 32 kc/s and is very effective for the production of emulsions. The operating cost of emulsification by means of the whistle is about 0.003 of that when magnetostriction oscillators are used.

539.16.08 **1443**

Further Experiments with an Adjustable Geiger-Müller Counter.—A. G. Fenton & E. W. Fuller. (*Proc. phys. Soc.*, 1st Jan. 1949, Vol. 62, No. 349A, pp. 32–40.) Discussion of the effect of various counter variables on the occurrence of multiple pulses, and of the performance of the counter as an ionization chamber at operating potentials below the Geiger region. For earlier work see 2578 of 1948 (Chaudhri & Fenton).

539.16.08 **1444**

Recent Research on [Geiger-Müller] **Counter Tubes.**—J. D. Craggs. (*Rep. Progr. Phys.*, 1942/1943, Vol. 9, pp. 137–155. Bibliography, pp. 155–157.) The work done on the mechanism of counters since about 1938 is reviewed. The main sections deal with proportional and non-proportional counters and their absolute efficiency. Their application to the counting of visible photons, X rays and neutrons is discussed. Directional, discriminating and other special types are briefly described.

539.16.08 **1445**

Two Methods of Measurement of Dead Time in Geiger-Müller Counters.—J. L. Putman & E. H. Cooke-Yarborough. (*J. sci. Instrum.*, Dec. 1948, Vol. 25, No. 12, pp. 409–411.)

539.16.08 : 621.383 **1446**

Performance of 931-A Type Multiplier in a Scintillation Counter.—G. A. Morton & J. A. Mitchell. (*RCA Rev.*, Dec. 1948, Vol. 9, No. 4, pp. 632–642.) The scintillation type of nuclear radiation detector uses such a multiplier to convert into an electrical pulse the light flash produced by a suitable phosphor crystal when it absorbs a nuclear particle. The main properties investigated are the number and distribution of spurious pulses generated by the multiplier in darkness and the pulse performance when very few photoelectrons contribute to the pulse.

620.179.16 **1447**

Supersonic Flaw Detectors.—D. C. Erdman. (*Elect. Engng, N.Y.*, Feb. 1948, Vol. 67, No. 2, pp. 181–185.) Echo techniques and apparatus.

621.38.001.8 : 621.3.012 **1448**

Handbook of Industrial Electronic Circuits. [Book Review]—Markus & Zeluff. (*See* 1345.)

621.38.001.8 : 621.9 **1449**

The Application of Electronics to Machine Tools.—(*Machinery, Lond.*, 11th Nov. 1948, Vol. 73, No. 1881, pp. 663–668.) Discussion of devices shown at the recent Machine Tools Exhibition at Olympia. In most cases the number of electronic devices used has been kept to a minimum, and the circuit arrangements are designed for long life and ease of maintenance. Service requirements have stimulated the production of rugged, shock-proof and moisture-proof components. Devices for obtaining stepless speed control, especially for small machines, were a prominent feature.

621.38.001.8 : 623.95 **1450**

Developments on Magnetic and Acoustic Mines at the Admiralty Mining Establishment.—A. J. Baggott & C. H. Fawcett. (*J. Instn elect. Engrs*, Part I, Dec. 1948, Vol. 95, No. 96, pp. 550–551.) Discussion on 790 of 1948.

621.384.62† **1451**

The Choice of Operating Mode for Standing Wave Type Linear Accelerators for Electrons.—E. J. Lawton. (*J. appl. Phys.*, June 1948, Vol. 19, No. 6, pp. 534–539.)

621.384.62† **1452**

Experimental Results on Standing Wave Type Linear Accelerators for Electrons.—E. J. Lawton & W. C. Hahn. (*J. appl. Phys.*, July 1948, Vol. 19, No. 7, pp. 642–648.)

621.385.833 **1453**

Chromatic Aberration and Resolving Power in Electron Microscopy.—E. G. Ramberg & J. Hillier. (*J. appl. Phys.*, July 1948, Vol. 19, No. 7, pp. 678–682.)

621.385.833 **1454**

Electron Microscopy.—L. Marton. (*Rep. Progr. Phys.*, 1944/1945, Vol. 10, pp. 204–248. Bibliography, pp. 248–252.) Magnetic lenses are discussed in some detail and formulae for focal length, magnification, chromatic and spherical aberration and optimum aperture are given, together with graphs showing their variation. Some experimental justification is given, and the superiority of magnetic over e.s. lenses is shown. The theory of resolving power is not so well understood but there is experimental evidence for assuming a limit to resolution of about 20 Å for bright field observation. For dark-field observation the limit is somewhat larger. General descriptions are given of the main types of electron microscopes and allied instruments, and in particular of a microanalyser and a microtome; the operational techniques involved are discussed.

621.385.833 **1455**

The Refractive Index in Electron Optics and the Principles of Dynamics.—W. Ehrenberg & R. E. Siday. (*Proc. phys. Soc.*, 1st Jan. 1949, Vol. 62, No. 349B, pp. 8–21.) A relation between the ray direction and the wave normal is obtained, and an expression for the optical path difference is given in terms of the magnetic flux enclosed. The results are applied to the differential equations for trajectories, the focusing properties of an axially symmetrical field and the interference pattern due to two converging bundles of rays enclosing a magnetic flux.

621.385.833 **1456**

Electron Lenses of Hyperbolic Field Structure : Part 2.—R. Rüdenberg. (*J. Franklin Inst.*, Nov. 1948, Vol. 246, No. 5, pp. 377–408.) If the lens voltage is increased above the incident electron voltage, the beam is at first blocked. A further increase converts the lens into a curved mirror, the focal properties of which are analysed. Boundary conditions which may be rigorously or approximately satisfied in actual designs are discussed, and the effects of lateral apertures and windows are considered in detail. Expressions are derived for various defects which are small and depend on only a few parameters of the lens field. The case of electron cylinder lenses is also considered. Part 1 : 813 of March.

621.385.833 **1457**

Electron Lens Corrected for Spherical Aberration.—P. Hubert. (*C. R. Acad. Sci., Paris*, 17th Jan. 1949, Vol. 228, No. 3, pp. 233–235.) The method of correction proposed consists in sending the electron beam through a narrow metal cylinder in order to use the attraction of the charges induced on the walls. Numerical calculations show that with such a system the resolving power is greatly improved. The method may have important applications in the case of the proton microscope.

621.385.833 **1458**

Electron Lens with Curvilinear Axis.—P. Hubert. (*C. R. Acad. Sci., Paris*, 24th Jan. 1949, Vol. 228, No. 4, pp. 302–304.) A magnetic lens with circular axis has been used by Svartholm & Siegbahn in the construction of a β-ray spectograph (1868 of 1947). It is possible to construct a lens whose magnetic field does not possess rotational symmetry. The theory of such a system is given and the practical advantages are enumerated.

621.385.833 : 537.533 : 530.145.6 **1459**

Field Emission of Electrons.—Jenkins. (*See* 1356.)

621.385.833.032.29 **1460**

On a New Electron Gun for High-Voltage Tubes.—M. Bricka & H. Bruck. (*Ann. Radioélect.*, Oct. 1948, Vol. 3, No. 14, pp. 339–343.) Detailed description of a gun used on C.S.F. electron microscopes and diffraction analysers. At 45 kV it gives a current density ten times that of the ordinary type of gun and has an efficiency of about 20%. The h.v. current is about 40 μA.

534.321.9.001.8 : 620.179.16 **1461**

Ultrasonic Material Testing and Other Applications. [Book Notice]—B.I.O.S. Final Report No. 1679, Item No. 9. H.M. Stationery Office, London, 68 pp. plus reprints in German from various German journals. Many different workers had obtained suggestive results indicating the possibility of industrial application of ultrasonics to emulsification, precipitation, preparation of fine grain alloys etc., but there was little evidence of actual use on an industrial scale. A magnetostriction technique was successfully used for both vertical and horizontal echo soundings. An ultrasonic glass delay line was also used in the Rehbock radar test set. Success in techniques for testing materials is claimed, though insufficient information is available as to the amount of material so tested. See also B.I.O.S. Final Reports Nos. 724 and 1504.

PROPAGATION OF WAVES

538.566 **1462**

On Formulae for the Principle of Huyghens for Electromagnetic Waves.—F. Croze & É. Durand. (*C. R. Acad. Sci., Paris*, 17th Jan. 1949, Vol. 228, No. 3, pp. 236–239.) Formulae have been given by L. de Broglie (3083 of 1944) which are equivalent to those of Kottler but in which the elements of a surface wave have only superficial densities of current and electric and magnetic charges. Application of these formulae to the determination of the electric field in a secondary wave emanating from an element of a surface wave leads to formulae established by Love, Larmor and Bromwich, so that de Broglie's formulae should be regarded as the correct expression of the principle of Huyghens, taken in its usual sense, for e.m. waves.

538.566 **1463**

On the Expression of the Principle of Huyghens for Electromagnetic Waves.—F. Croze & P. Boillet. (*C. R. Acad. Sci., Paris*, 24th Jan. 1949, Vol. 228, No. 4, pp. 305–307.) The formulae of Love, Larmor and Bromwich for e.m. waves are derived directly from the classical formulae for the fields produced by electric and magnetic doublets. See also 1462 above (Croze & Durand).

538.566 **1464**

Generalized Magneto-Ionic Theory.—N. C. Gerson & S. L. Seaton. (*J. Franklin Inst.*, Dec. 1948, Vol. 246, No. 6, pp. 483–494.) A vector equation relating the polarization of a homogeneous isotropic medium to the externally impressed magnetic field is derived for the case of a medium penetrated by an e.m. wave. The equation involves the fourth degree of the refractive index and is a generalization of that obtained by Booker (422 of 1939) for a 2-dimensional case.

538.566 : 551.510.535 **1465**

On the Polarization in the Ionosphere.—J. Malsch. (*Arch. elekt. Übertragung*, June/July 1948, Vol. 2, Nos. 6/7, pp. 231–237.) Evidence from various sources is discussed which suggests that the so-called Lorentz term is not applicable in ionospheric propagation.

538.566.2 **1466**

Propagation of Electromagnetic Perturbations in an Atmospheric Waveguide.—T. Kahan & G. Eckart. (*C. R. Acad. Sci., Paris*, 17th Jan. 1949, Vol. 228, No. 3, pp. 235–236.) An outline of the physical phenomena in an ideal plane atmospheric duct bounded by a perfectly conducting earth and a parallel plane at a height h where the index of refraction has a discontinuity. Mathematical theory will be published elsewhere. For low values of h the field F of the dipole source at distance r varies as $1/r^3$, but above a limiting value of h/λ, $F \propto 1/\sqrt{r}$ and the energy is propagated in cylindrical waves of the TE type.

538.566.2 **1467**

Representation of the Radiation in an Atmospheric Duct by a Series of Virtual Sources.—T. Kahan & G. Eckart. (*C. R. Acad. Sci., Paris*, 24th Jan. 1949, Vol. 228, No. 4, pp. 304–305.) Near the origin the field in the duct can be derived by superposing, on the field of a dipole of double strength, the fields due to successive images of this dipole with respect to (*a*) the plane forming the upper boundary of the duct, and (*b*) the earth. This representation is valid up to a distance such that the ray from the first virtual image makes an angle with the horizontal at least equal to the angle of total reflection at the boundary layer. At greater distances the field strength follows either the $1/r^3$ or the $1/\sqrt{r}$ law (see 1466 above).

621.396.1 **1468**

Diversity Reception in U.S.W. Radio Links.—G. Barzilai & G. Latmiral. (*Wireless Engr*, Dec. 1948, Vol. 25, No. 303, pp. 390–395.) The proper disposition of the receiving aerials is considered theoretically, taking account of the way in which they are connected to the receiver. Results are applied to a practical case.

621.396.11 **1469**

Coastal Refraction.—T. L. Eckersley. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 97–110. In English.) The fact that the velocity of e.m. waves over land is less than their velocity over sea is inconsistent with Zenneck's surface-wave theory, but this theory is not considered relevant. The result can be obtained from pure diffraction theory. The difference in velocity (and therefore coastal refraction) is only significant at wavelengths between 15 and 1 500 m.

621.396.11 **1470**

The Future of Wave Propagation Research.—S. B. Smith & K. W. Tremellen. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 196–210. In English.) A survey of present knowledge and possible future developments for (*a*) atmospherics and extra-terrestrial radiations, (*b*) v.h.f. propagation (above 30 Mc/s) and superrefraction, (*c*) h.f. propagation (3–30 Mc/s), (*d*) m.f. ground-wave propagation and ionospheric transmission paths (0.15–3 Mc/s), (*e*) l.f. propagation (10–150 kc/s).

621.396.11 **1471**

General Remarks on the Theory of Wave Propagation.—H. Bremmer. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 30–42. In English.) Discussion of the effects of earth curvature, refraction and diffraction, and the relevance of both ray theory and mode theory.

621.396.11 **1472**

Mechanisms of Propagation.—C. R. Burrows. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 43–51. In English.) Discussion of refraction, diffraction, and ionospheric and guided tropospheric propagation.

621.396.11 **1473**

Studies in Propagation.—T. L. Eckersley. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 78–96. In English.) A critical survey. The properties of the ionosphere are discussed with reference to the problems of scatter clouds in the E layer, abnormal-E, and abnormal-F. Propagation over land and sea paths is discussed in some detail for $\lambda \leqslant 10$ m. The importance of the phase-integral method is stressed.

621.396.11 : 551.510.535 **1474**

A Note on the Phase Difference between Two Waves Reflected from the Ionosphere.—J. M. Kelso. (*J. appl. Phys.*, June 1948, Vol. 19, No. 6, pp. 590–591.) Two relations given without proof by Appleton & Beynon (2895 of 1947) are discussed and shown to have wide validity.

621.396.11 : 551.510.535 **1475**

Regular Ionosphere Observations over Mid-Germany.—W. Dieminger. (*Fernmeldetech. Z.*, Nov. 1948, Vol. 1, No. 8, pp. 222–224.) Diagrams show the diurnal variations of the monthly mean values of limiting frequency for the normal and abnormal E layers and for the F_2-layer ordinary component from January to October, 1948. Disturbances which occurred during October are briefly discussed.

621.396.11 : 551.510.535 **1476**

The Verification of Magneto-Ionic Theory from the Gyrointeraction of Radio Waves in the Ionosphere.—M. Cutolo. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 65–77. In Italian.) Experimental results confirm V. A. Bailey's theory of gyrointeraction. The fact of gyrointeraction shows that there is an ionospheric resonance frequency in the sense indicated by Nicholls & Shelleng. A nocturnal variation was observed in the gyromagnetic frequency. The experimental methods discussed can be used to study the distribution of the earth's magnetic field in the ionosphere. See also 513 of 1947 (Cutolo, Carlevaro & Ghergi) and 2055 of 1948.

621.396.11 : 551.510.535 **1477**

Measurement of the Parasitic Modulation in Gyrointeraction Phenomena.—M. Cutolo & R. Ferrero. (*Alta Frequenza*, Oct. 1948, Vol. 17, No. 5, pp. 212–216. In Italian, with English, French and German summaries.) An account of measurements on transmission paths between Turin and Taranto, Augusta and Palermo, with the Vatican transmitter as the interfering element. Curves show the variation of the parasitic modulation as a function of (*a*) the modulation frequency of the interfering station, and (*b*) time.

621.396.11 : 551.594.21 **1478**

Guided Propagation of Radar in Thunderstorm Conditions.—R. D. Coons. (*Bull. Amer. met. Soc.*, Sept. 1947, Vol. 28, No. 7, pp. 324–329.) Discussion of the behaviour of radar echoes during thunderstorm conditions. A series of photographs of a p.p.i. presentation shows the passage of storm clouds, and the abnormal range of ground echoes resulting from guided propagation caused by stratification of water vapour in the rain areas under the cloud.

621.396.11 : 621.396.619.13 : 621.396.65 **1479**

The Possibility of Transatlantic Transmission by means of Frequency Modulation.—Arguimbau & Granlund. (*See* 1506.)

621.396.81 : 621.397.5 **1480**

Field Test of Ultra-High-Frequency Television in the Washington Area.—G. H. Brown. (*RCA Rev.*, Dec. 1948, Vol. 9, No. 4, pp. 565–584.) A survey of the field strength of the signals from a broadcast transmitter operating in the 500-Mc/s band is described. The measurements were made at points along eight radial lines and also in about 50 homes with typical home receivers. From the results the power required for satisfactory coverage was determined. Measurements in the homes were also made of the signal voltage for the existing 67.25-Mc/s television service and for transmissions on 505.25 Mc/s. Performances of various types of receiving aerials are compared. See also 3224 of 1948 (Brown, Epstein & Peterson).

621.396.812.029.64 **1481**

A Method of Determining the Angle of Arrival.—A. W. Straiton, W. E. Gordon & A. H. LaGrone. (*J. appl. Phys.*, June 1948, Vol. 19, No. 6, pp. 524–533.) The angles of arrival of the direct and reflected rays are determined by measuring the phase difference for two points at different heights and the field strength at each point. Values obtained for 3-cm radiation over a 27-mile path are consistent with those calculated by ray theory, taking account of the refractive-index distribution deduced from meteorological measurements. See also 1182 of 1947 (Sharpless) and 1183 of 1947 (Crawford & Sharpless).

RECEPTION

621.396.1 **1482**

Diversity Reception in U.S.W. Radio Links.—Barzilai & Latmiral. (*See* 1468.)

621.396.621 **1483**

On the Use of a Superregenerator in the Nonlinear Mode for the Reception of F.M. Signals.—G. B. Ol'derogge. (*Radiotekhnika, Moscow*, Nov./Dec. 1948, Vol. 3, No. 6, pp. 76–87. In Russian.)

621.396.621 : 534.861 **1484**

The Acoustics of Broadcasting Receivers.—Govyadinov. (*See* 1267.)

621.396.621 : 621.3.015.3 **1485**

Transient Response of an F.M. Receiver.—M. K. Zinn. (*Bell Syst. tech. J.*, Oct. 1948, Vol. 27, No. 4, pp. 714–731.) The frequency detector is represented by two resonant impedances with low-frequency outputs in opposition. Mathematical treatment permits the calculation of the output voltage for rapid variation of the instantaneous frequency. Very large impulsive variations, resulting in abrupt changes of phase, such as may be produced by ignition interference, are analysed and curves of output voltage are obtained. The method is also used to analyse the reception of a simple sinusoidal modulation; the signal/noise ratio is deduced for severe impulsive interference.

621.396.82 : 621.397.5 **1486**

The Effect of Aircraft on the Reception of Transmissions in the 45-Mc/s Band.—R. A. Rowden & G. I. Ross. (*B.B.C. Quart.*, Jan. 1949, Vol. 3, No. 4, pp. 251–256.) Reflection of radio waves from aircraft can have a disturbing effect upon v.h.f. reception. Tests with random aircraft indicate that interference is serious only when the aircraft is within 6 miles of the receiver or within 3 miles of the line joining the transmitter and receiver. The fluctuations in field strength of horizontally-polarized transmissions are three or four times as great as those with vertically-polarized transmissions. Experiments with co-operating aircraft gave similar results.

621.396.822 **1487**

Report on the Present Limits of V.H.F., U.H.F. and S.H.F. Reception.—M. J. O. Strutt. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 412–442. Bibliography, pp. 442–447. In English.) A review of various causes of unwanted r.f. noise, for frequencies between 30 and 30 000 Mc/s, with discussion of (*a*) the admissible signal/noise ratio for various types of transmission and the present definition of noise figure, (*b*) thermal external noise, the aerial being regarded as enclosed in a space of dimensions large compared to λ, and in thermal equilibrium at the temperature of that space, (*c*) atmospheric and man-made noise, including the propagation of atmospherics, (*d*) ionospheric and extraterrestrial noise, with special reference to the temperature, location and frequency bands of the various sources, (*e*) thermal fluctuations in resistive elements of a network, (*f*) valve and crystal noise, (*g*) low-noise circuits and methods of noise reduction, (*h*) actual noise levels obtainable at the various frequencies.

621.396.822 **1488**

Noise in Linear Networks.—E. J. Schremp. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 402–411. In English.) A mathematical analysis of the possible alternative representations of a passive or active linear network containing bilateral or non-bilateral elements. The results are applied mainly to thermal noise and various forms of shot noise in multi-electrode valves.

621.396.822 **1489**

Thermal Noise Output in A.M. Receivers.—M. V. Callendar. (*Wireless Engr*, Dec. 1948, Vol. 25, No. 303, pp. 395–399.) Formulae given by Burgess for noise and signal outputs from rectifiers are examined, and criteria for the variation of signal/noise ratio with pre-detector bandwidth and signal input to the detector are shown graphically. Practical conclusions are given for television sound, telephony and telegraphy receivers. See also 534 of 1948 (Thomas & Burgess).

STATIONS AND COMMUNICATION SYSTEMS

621.39.001.11 **1490**

A Mathematical Theory of Communication.—Shannon. (*See* 1361.)

621.391.63 : 534.321.9 **1491**

On the Modulation of Light at Radio Frequencies by means of Ultrasonic Waves.—Giacomini. (*See* 1255.)

621.394/.395 + 621.315.2 **1492**

French Telecommunication Networks.—J. Mailley; J. Gastebois. (*Câbles & Transmission, Paris*, Jan. 1949, Vol. 3, No. 1, pp. 8–30. With English summary.) Developments from 1924 to 1949 of carrier-current, overhead, underground and underwater cables are discussed and present-day local and long-distance telegraphy and telephony systems are described.

621.394/.395].724 **1493**

Repeater-Station Equipment.—J. Malézieux & R. Sueur. (*Câbles & Transmission, Paris*, Jan. 1949, Vol. 3, No. 1, pp. 66–82. With English summary.) Review of developments since 1924, with special reference to standardization and carrier-current systems.

621.394/.395].74 **1494**

Maintenance of the Network of Long-Distance Underground Lines.—R. Croze ; A. Chavigner. (*Câbles & Transmission, Paris*, Jan. 1949, Vol. 3, No. 1, pp. 106–133. With English summary.)

621.394/.395].74 **1495**

Electro-Mechanical Installations of the Amplification Centres of the [French] **Long-Distance Cable Network.**—A. Romanet. (*Câbles & Transmission, Paris*, Jan. 1949, Vol. 3, No. 1, pp. 83–95. With English summary.) A general description of the power supplies normally required at an amplification centre, the operating conditions, and the evolution of suitable equipment, including batteries, rectifiers, voltage regulators and generators.

621.394/.395].74 **1496**

The Future of the French Telecommunication Network.—P. Marzin. (*Câbles & Transmission, Paris*, Jan. 1949, Vol. 3, No. 1, pp. 134–136. With English summary.)

621.395.44 **1497**

Carrier-Current Systems on Overhead Lines.—R. Sueur. (*Câbles & Transmission, Paris*, Jan. 1949, Vol. 3, No. 1, pp. 96–105. With English summary.) A short account of various single- and multi-channel systems developed in France.

621.396 **1498**

Recent Developments in Radio Communication in Great Britain.—M. Faulkner. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 752–787. In English.) A general account of some developments in the radio and allied services of the British Post Office. Details are given of point-to-point radio systems, alterations at pre-war stations, and post-war developments. A proposed R/T terminal in N.W. London is to have initially at least 48 terminal equipments. The extension of single-sideband operation to long-distance point-to-point R/T links is planned; the main features of the equipment are described. Results of laboratory tests with a fading machine (2299 of 1948) on the effect of propagation conditions are discussed and illustrated graphically. The relaying of television signals by balanced, coaxial and unloaded telephone cables is considered and details are given of a special universal equalizer for quick reliable testing of video circuits. Plans are outlined for the extension of (*a*) outside broadcast networks in London, and (*b*) long coaxial-cable routes for transmission from the programme source to distant service areas. The proposed method of relaying television signals by radio from London to Birmingham is described.

621.396.1 : 061.3 **1499**

International Telecommunication Convention, Atlantic City, 1947.—P. E. Erikson. (*Elect. Commun.*, Sept. 1948, Vol. 25, No. 3, pp. 232–236.) Discussion of important changes or additions to the Madrid Convention of 1932. For other accounts see 1748, 1749 and 2357 of 1948.

621.396.3.029.56/.58 **1500**

Multi-Channel Radio-Telegraph System for High-Frequency Circuits.—T. E. Jacobi. (*RCA Rev.*, Dec. 1948, Vol. 9, No. 4, pp. 704–720.) Sub-carrier channels using f.m. in conjunction with single-sideband operation and space-diversity reception appeared from field tests to be the best of several systems tried; error rates of 0.02–0.14% were obtained on a transcontinental circuit. Double-sideband circuits had high error rates during periods of selective fading; these could be reduced to the above values by using exalted-carrier receivers. Single-sideband systems make better use of the frequency band available and use the transmitter power more efficiently. Under present conditions of h.f. congestion, reduction of bandwidth and increase of message capacity must be regarded as of paramount importance.

621.396.324 **1501**

Teleprinting over Radio Circuits.—H. C. A. van Duuren. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 902–914. In English.) Description of a reliable telegraph circuit between Amsterdam and Batavia. Each letter is transmitted on a 7-unit code. When a fault is detected, the printer stops, a signal is given on the return path, and the transmitter is stepped back to the beginning of the faulty letter.

621.396.41 : 621.396.619.16 **1502**

Multiplex Radiotelephony Link between the Mainland and Corsica.—P. Rivère. (*Ann. Radioélect.*, Oct. 1948, Vol. 3, No. 14, p. 338.) Corrections to 3508 of 1948.

621.396.5 **1503**

Radio for Telephone Service in America.—H. I. Romnes. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 851–876. In English.) An account of methods used by the Bell System. A description of overseas R/T includes a world map of the direct and principal interconnecting services, existing and planned. Service to ships, a general mobile service, a domestic point-to-point system using the 30–300-Mc/s band, and a microwave relay system between New York and Boston are also discussed.

621.396.619.11/.13 **1504**

A.M. and Narrow-Band F.M. in U.H.F. Communications: Parts 1 & 2.—E. Toth. (*Electronics*, Feb. & March 1949, Vol. 22, Nos. 2 & 3, pp. 84–91 & 102–108.) A comparison based on a long-term study undertaken at the U.S. Naval Research Laboratory, dealing with typical conditions for mobile Navy communications. Advantages of a.m. include : (*a*) better weak-signal performance, (*b*) relative freedom from co-channel and adjacent-channel interference, (*c*) lower susceptibility to multipath propagation difficulties, (*d*) a.m. occupies a narrower frequency range, especially at low carrier frequencies, (*e*) ease of equipment alignment, (*f*) tolerance of severe detuning, and (*g*) circuit simplicity. F.m. has advantages for geographically fixed communication and broadcast systems, particularly for high-fidelity reproduction of speech and music. In general f.m. permits the use of a smaller transmitter and requires less power for a given carrier-output rating. Transmitter modulation is difficult for f.m. crystal-controlled systems.

621.396.619.11/.13 **1505**

Reduction by Limiters of Amplitude Modulation in an Amplitude- and Frequency-Modulated Wave.—A. G. Clavier, P. F. Panter & W. Dite. (*Elect. Commun.*, Sept. 1948, Vol. 25, No. 3, pp. 291–299.) The limiting action of ideal and imperfect limiters is analysed mathematically by the use of the Fourier transform. Curves are given, for various applied carrier voltages, showing the reduction of a.m. by theoretical limiters having static characteristics represented by known mathematical functions. See also 3110 of 1944 (Bennett).

621.396.619.13 : 621.396.65 : 621.396.11 **1506**

The Possibility of Transatlantic Transmission by Means of Frequency Modulation.—L. B. Arguimbau & J. Granlund. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 671–679. In English.) An analysis of the problem of multipath interference to f.m. telephonic communication. An experimental circuit is described in which a source using f.m. is fed to the receiver through two paths, one a simple attenuator and the other a $\frac{1}{2}$-ms supersonic delay line. Preliminary tests appear promising.

621.396.65 : 621.396.41 **1507**

Multiplex U.H.F. Radiotelephone Links.—H. Chireix. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 717–745. In French.) Methods of calculating signal/noise ratio, fully discussed in 2902 of 1947, are summarized. For systems using simple carrier-current f.m., high signal/noise ratio can be obtained for a large number of channels. Overmodulation effects are much less serious than for a.m. The pass band is relatively narrow. These advantages are offset by high cost, which is greatly reduced if two coaxial cables equipped for carrier current are available. Double carrier-current f.m. is a system particularly suitable at cm λ; reflex klystrons are used whose frequency can at present be varied by as much as ± 7 Mc/s at 3 000 Mc/s; the disadvantage of low power output is likely to be rectified soon. Pulse-time modulation systems have the advantage of requiring simple apparatus which can be easily installed. The main disadvantages are that signal/noise considerations tend to limit their use to multiplex links with only a small number of channels, crosstalk may be very objectionable and the pass band required is appreciably wider than for the f.m. systems considered. See also 2307 of 1946.

621.396.65(45) **1508**

Experimental U.S.W. Multiplex Radiotelephone Link between Milan and Rome.—F. Vecchiacchi. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 915–927. In Italian.) The total direct distance is 475 km; two intermediate mountain relay stations are used, so that this is split up into optical paths of 160, 260 and 70 km. Frequencies are between 150 and 220 Mc/s, with horizontal polarization. There are 7 channels. Performance has been continuously satisfactory; crosstalk is completely absent. See also 3750 of 1946.

621.396.931 **1509**

Railroad Radio.—W. D. Hailes. (*Elect. Engng, N.Y.*, Jan. 1949, Vol. 68, No. 1, pp. 1–7.) Description of two systems and the associated equipment: (*a*) a narrow-band f.m. system inductively coupled to telegraph wires near the track; frequency is between 70 and 200 kc/s, input power 270 W, output 30–40 W, range about 30 miles train-to-station or 15–20 miles between trains; (*b*) a 4-channel f.m. space radiation system; input power is 425 W, radiated power 50 W, bandwidth 1.2 Mc/s; range depends upon terrain but is usually less than for system (*a*). The advantages and uses of both systems are discussed.

621.396.932.029.63 **1510**

An Early Application of Decimetre Waves to Communication between Ships.—E. C. S. Megaw & W. E. Willshaw. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 790–828. In English.) Experimental work in the development, for the Admiralty, of equipment to provide reliable all-round communication at distances up to 3 miles. The stabilized transmitter used a 4-segment magnetron and provided frequencies of 515, 530, 635 and 650 Mc/s by means of plug-in resonators. Modulation was effected by a.f. interruption of the carrier, with marking and spacing frequencies of 1 000 c/s and 3 200 c/s respectively. The oscillatory circuit of the superregenerative receiver consisted of a short length of parallel-strip line; this was tuned by a symmetrical capacitor, on the stator plates of which an acorn triode was mounted. The frequency range 415–705 Mc/s was covered in 8 steps, selected by changing the position of a preset capacitor bridge. The aerial, of constant impedance $70\ \Omega$, comprised a $\lambda/4$ radiator with a $\lambda/4$ compensating reactance transformer. Details are given of equipment performance during trials in 1939 and of measurements made to determine diffraction losses produced by masts and superstructure. A much simplified model was built in 1940 to provide a single communication channel.

621.396.933 **1511**

Aircraft Radio Communication Set A.R.I.5272.—E. C. Fielding. (*Elect. Commun.*, Sept. 1948, Vol. 25, No. 3, pp. 244–255.) Description of an a.m. transmitter-receiver originally designed for naval aircraft. Any of 4 predetermined crystal-controlled spot frequencies in the range 115–140 Mc/s can be selected by a switch; channel-changing only takes 3 sec. The transmitter output is 3.5 W and the range is 100 miles to ground or 200 miles to another aircraft. The set can be used under extreme tropical or arctic conditions.

621.396.97(73) **1512**

F.M. Broadcasting in the United States.—E. M. Ostlund & G. S. Wright. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 829–850. In English.) Results of tests in the broadcast band 88–105 Mc/s on f.m. and a.m. receivers show that the former have better signal/noise ratio and freedom from interference. F.m. transmitters, methods of modulation and transmitting aerial systems are discussed. A brief account of networks in operation in the U.S.A. includes a contour radiation pattern for a typical station. The advantages of using f.m. at v.h.f. are summarized.

SUBSIDIARY APPARATUS

621.316.7.078 : 016 **1513**

List of Russian Articles on Questions of Automatic Regulation and Following Systems for the Period 1917-1947.—(*Avtomatika i Telemekhanika*, Sept./Oct. 1948, Vol. 9, No. 5, pp. 397–411. In Russian.)

778.53 **1514**

Motion Picture Photography at Ten Million Frames per Second.—B. O'Brien & G. Milne. (*J. Soc. Mot. Pict. Engrs*, Jan. 1949, Vol. 52, No. 1, pp. 30–40.) The area to be photographed is transformed by a stationary multiple-lens and slit optical system into a number of narrow rectangles placed end to end across the moving film. The negative so formed is afterwards projected back through a similar optical system to reform a set of normal images for printing. The equipment is described in detail and illustrated, and examples of records are shown.

TELEVISION AND PHOTOTELEGRAPHY

621.397.26 **1515**

The [British] **Post Office Phototelegraph Service to Europe.**—A. Wilcock. (*P.O. elect. Engrs' J.*, Jan. 1949, Vol. 41, Part 4, pp. 189–192.) The picture to be transmitted is scanned by light which is reflected on to a photocell whose output is used to provide a single-sideband a.m. transmission at 1 300 c/s. Synchronization and phasing signals are also transmitted. Both transmitter and receiver are driven by phonic motor from the output of oscillators with tuning-fork control. At the receiver the fork frequency is synchronized manually with that at the transmitter; the receiver drum is automatically started in phase with the transmitter drum. The received picture signal is demodulated in a metal bridge rectifier and converted into a light trace by a Duddell oscillograph recording on photographic paper or film.

621.397.331.2 : 621.397.5 **1516**

Electro-Optical Characteristics of Television Systems : Part 4 — Correlation and Evaluation of Electro-Optical Characteristics of Imaging Systems.—O. H. Schade. (*RCA Rev.*, Dec. 1948, Vol. 9, No. 4, pp. 653–686.) Continuation of 540 of February.

621.397.5 **1517**

Recent Progress in Television.—V. K. Zworykin. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 928–946. In English.)

621.397.5 : 621.315.212 **1518**

The London-Birmingham Television Cable : Part 1 — General System and Electrical Requirements.—Stanesby & Weston. (*See* 1279.)

621.397.5 : 621.396.81 **1519**

B.B.C. Television Map.—(*Wireless World*, Feb. 1949, Vol. 55, No. 2, pp. 55, 74.) Field-strength contours for the Alexandra Palace 45-Mc/s video transmitter.

621.397.5 : 621.396.81 **1520**

Field Test of Ultra-High-Frequency Television in the Washington Area.—Brown. (*See* 1480.)

621.397.5 : 621.396.813 **1521**

Delay Distortion in Television Transmission and its Measurement.—S. H. Padel. (*B.B.C. Quart.*, Jan. 1949, Vol. 3, No. 4, pp. 235–244.) Delay distortion can be estimated from the phase/frequency characteristic or from modulation phase shift. The methods are described in detail. Block diagrams of measuring apparatus are given, and the degree of improvement made possible by delay equalizers is discussed.

621.397.5 : 621.396.82 **1522**

The Effect of Aircraft on the Reception of Transmissions in the 45-Mc/s Band.—Rowden & Ross. (*See* 1486.)

621.397.5 : 791.45 **1523**

Television in the Cinema.—A. G. D. West. (*Wireless World*, Feb. 1949, Vol. 55, No. 2, pp. 42–44.) A discussion of distribution methods, based on a paper read at the International Television Convention at Zürich (867 of March). A long-term proposal involves a very-high-definition system (900–1 200 lines) which will link up cinemas all over Britain and provide a variety of television programmes. An experimental large-screen television service is also being developed with the existing 405-line definition. Various programmes can be relayed over 480-Mc/s radio links to selected London cinemas. See also 240 of January.

621.397.5(083.74) **1524**

Comments on Standardisation of European Television Services.—B. J. Edwards. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 746–751. In English.) A frame-scan frequency of 50 c/s, a standard interlacing index, and 405 lines per frame are advocated; detailed reasons are given. Various technical improvements are also suggested.

621.397.5(44) **1525**

French Work on Television.—R. Barthélemy. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 680–682. In French.)

621.397.62 **1526**

Motorola Television Receiver — Model VT.71.—(*Radio franç.*, Feb. 1949, No. 2, pp. 10–13.) Discussion of general characteristics and special features, together with a detailed circuit diagram.

621.397.62 **1527**

Superheterodyne Television Unit : Part 1.—(*Wireless World*, Feb. 1949, Vol. 55, No. 2, pp. 61–65.) Circuit and construction of a long-range sound and vision receiver. Single-sideband operation and rejector circuits are used to secure adequate sound-channel rejection. It is expected that only minor modifications will be necessary for reception of the future B.B.C. Birmingham transmissions. The unit can be used with an external audio amplifier and may replace the straight receiver described previously (1186 of 1948 and back references). To be continued.

621.397.645 **1528**

Stagger-Peaked Video Amplifiers.—Easton. (*See* 1344.)

TRANSMISSION

621.396.61 **1529**

Description of a 1-kW Medium-Wave Broadcasting Transmitter.—P. Paris & J. Polonsky. (*Ann. Radioélect.*, Oct. 1948, Vol. 3, No. 14, pp. 293–298.) The feedback principles previously described (3377 of 1948) are applied in a transmitter for the range 272.5–750 kc/s; it can be used with or without crystal control and can form the driving unit of a high-power transmitter. Performance curves are given.

621.396.61.029.62 **1530**

The "Little Slugger".—P. S. Rand. (*QST*, Feb. 1949, Vol. 33, No. 2, pp. 11–17, 122.) Constructional and operating details of a low-power crystal-controlled 10-m transmitter using narrow-band f.m. Adequate filtering prevents television interference. The unit may be used as a narrow-band f.m. exciter for an a.m. transmitter of higher power.

621.397.61.029.63 **1531**

Developmental Television Transmitter for 500-900 Mc/s.—R. R. Law, W. B. Whalley & R. P. Stone. (*RCA Rev.*, Dec. 1948, Vol. 9, No. 4, pp. 643–652.) The development of valves and circuits for a wide-band transmitter giving a peak output power of 1 kW is described. For video modulation a pair of u.h.f. pulse triodes are used for cathode modulation of the push-pull r.f. amplifier. A feature of the output valves is the tungsten-wire grid which has negligible emission because of its excellent cooling properties.

621.396.615.141.2 **1532**

The Turbator, a Single-Cavity Magnetron.—Lüdi. (*See* 1556.)

621.396.619 : 621.396.5 **1533**

Systems of Modulation for Radio-Telephone Transmitters.—R. Vaudetti. (*Atti del Congresso internazionale della Radio, Rome*, Sept. /Oct. 1947, p. 519. In Italian.) Summary only. In the first system the modulation transformer is replaced by two inductances, each with two windings, acting as autotransformers. In the second, applicable where the final stage has valves in parallel, the valves of the modulated stage are arranged in series with those of the modulator stage; load matching is thus improved.

VALVES AND THERMIONICS

621.383 **1534**

The Physical Characteristics of Silver Sulphide Photocells.—V. E. Kosenko & E. G. Miselyuk. (*Zh. tekh. Fiz.*, Nov. 1948, Vol. 18, No. 11, pp. 1369–1377. In Russian.)

621.383 **1535**

The Structure and the Peculiarities in the Operation of Silver Sulphide Photocells.—I. R. Potapenko. (*Zh. tekh. Fiz.*, Nov. 1948, Vol. 18, No. 11, pp. 1356–1368. In Russian.)

621.383 **1536**

The Frequency Characteristics of Lead Sulphide Photocells.—B. T. Kolomiets. (*Zh. tekh. Fiz.*, Nov. 1948, 1948, Vol. 18, No. 11, pp. 1456–1457. In Russian.)

621.383 **1537**

Comparison of Lead-Sulfide Photoconductive Cells with Photoemissive Tubes.—N. Anderson & S. Pakswer. (*J. Soc. Mot. Pict. Engrs*, Jan. 1949, Vol. 52, No. 1, pp. 41–48.) A comparison of the electrical characteristics and a discussion of the modifications required in present practice in the cinema industry to obtain optimum performance.

621.385 **1538**

Electron Tube Development and its Place in the Progress of Radio Art.—I. E. Mouromtseff. (*Atti del Congresso internazionale della Radio, Rome*, Sept./Oct. 1947, pp. 544–577. In English.) A general review of the main developments during the author's lifetime, with discussion of (*a*) water-cooled valves, (*b*) sealing, (*c*) h.f. and u.h.f. valves, (*d*) the split-anode magnetron, (*e*) normal and reflex klystrons, (*f*) valves for pulse operation, (*g*) multi-cavity magnetrons, (*h*) the resnatron, and (*i*) the travelling-wave valve.

621.385 **1539**

Use of Optical Polish in Valve Construction.—A. Danzin & E. Despois. (*Ann. Radioélect.*, Oct. 1948, Vol. 3, No. 14, pp. 280–289.) The conditions which must be satisfied for an airtight joint between two surfaces are discussed, experimental work is described and applications to the construction of both demountable and ordinary valves are illustrated.

621.385 **1540**

Analysis of a Simple Model of a Two-Beam Growing-Wave Tube.—L. S. Nergaard. (*RCA Rev.*, Dec. 1948, Vol. 9, No. 4, pp. 585–601.) The gain and bandwidth of a mathematical model of a tube in which a growing wave is produced by the interaction of two electron beams is investigated. The model consists of two admixed beams, infinite in extent, and uniform except in the common direction of their velocities. The gain per unit length of the model is found to depend on the operating frequency, the current densities and the velocities of the two beams. With a tube having an interaction space 30 cm long, a gain of 120 db at 3 000 Mc/s, with a bandwidth of 860 Mc/s, should be practicable.

621.385 : 621.316.726.078 **1541**

The Transitrol, an Experimental Automatic-Frequency-Control Tube.—J. Kurshan. (*RCA Rev.*, Dec. 1948, Vol. 9, No. 4, pp. 687–703.) The transitrol combines the function of local oscillator and reactance device into a single unit particularly suitable for the v.h.f. band. Experiments with commercial valves which led up to its design are discussed; its operation is analysed. Its uses in f.m. receivers and as a f.m. transmitter are considered. See also 1235 of April.

621.385.012 **1542**

The Correspondence between the Static Characteristics and the Dynamic Parameters of Electrical Negative-Resistance Devices.—G. Cartianu. (*Onde élect.*, Jan. 1949, Vol. 29, No. 262, pp. 44–50.) Certain types of static characteristic can only correspond to certain dynamic parameters and hence to certain conditions of stability. Thus a device with a dynatron type of characteristic behaves as an inductance, while one with a characteristic of the arc type behaves as a capacitance. General rules are given for determining, from the features of the static characteristic, whether a particular device is of the inductance or the capacitance type.

621.385.029.63/.64 **1543**

Transverse Fields in Traveling-Wave Tubes.—J. R. Pierce. (*Bell Syst. tech. J.*, Oct. 1948, Vol. 27, No. 4, pp. 732–746.) A mathematical treatment of the problem of weak focusing fields. Travelling-wave valves will have gain even if the r.f. field at the mean position of the electron stream is purely transverse. The addition of a longitudinal magnetic focusing field reduces the gain due to transverse fields and increases the electron velocity for optimum gain. See also 2284 of 1947.

621.385.029.63/.64 **1544**

On the Properties of Valves using a Constant Magnetic Field : Part 3.—J. Brossart & O. Doehler. (*Ann. Radioélect.*, Oct. 1948, Vol. 3, No. 14, pp. 328–338.) A new type of valve is described, the travelling-wave valve with magnetic field. Two possible designs are considered, in each of which the cathode is a short cylinder with a gap, the anode a delay line of zigzag type surrounding the cathode, and a uniform magnetic field is applied in the direction of the axis. A h.f. signal is applied to one end of the anode line and is picked up near the other end by a collector plate which also serves as a screen between input and output. The gain of such a valve is calculated, neglecting space-charge effects. The new valve has considerable advantages compared with the normal travelling-wave valve. The gain is much greater and electron currents of the order of 1 A can be used, compared with 10–20 mA for the normal type of valve. The efficiency is also greater and there are only two systems of forced oscillations, while the normal valve has three. Parts 1 & 2, 261 of January. To be continued.

621.385.029.64 : 621.397.6 **1545**

On the Help which some Recent Ideas concerning U.H.F. Valves can give in Television.—R. Warnecke & P. Guénard. (*Ann. Radioélect.*, Oct. 1948, Vol. 3, No. 14, pp. 259–280 ; erratum, Jan. 1949, Vol. 4, No. 15, p. 92.) Full paper. Summary noted in 904 of March.

621.385.032.213 **1546**

Spectral Emissivity and Electron Emission Constants of Thoria Cathodes.—T. E. Hanley. (*J. appl. Phys.*, June 1948, Vol. 19, No. 6, pp. 583–589.) The relation between true and brightness temperatures for cataphoretically deposited thoria cathodes is obtained and the constants of the Richardson equations are found from electron emission studies.

621.385.032.213 : 621.314.67 **1547**

Hot-Cathode Gas-Filled Rectifying Valves.—R. Suart. (*Radio franç.*, Jan. 1949, No. 1, pp. 17–20.) The characteristics of such valves are discussed and two valves with xenon filling (Types VX.550 and VX.7400) are described. These have mean rectified anode currents of 0.35 A and 1.25 A respectively and a maximum inverse voltage of 10 000 V.

621.385.032.216 **1548**

Poisoning Effects in Oxide-Cathode Valves.—G. H. Metson. (*P.O. elect. Engrs' J.*, Jan. 1949, Vol. 41, Part 4, pp. 204–205.) Poisoning effects due to electron bombardment of the control grid of a valve occur at energies of the bombarding electrons corresponding to the heats of formation of compounds (oxide, chloride and sulphate) contained in normal cathode paste and apt to be evaporated from the cathode and deposited on the grids of a valve during manufacture. It is suggested that this poisoning occurs throughout the normal life of a valve and is reversible, the cathode reactivating by expulsion of gas when the supply of primary poisoning compounds on the grids is exhausted. In addition there appears to be an allied, but irreversible, effect due to progressive failure of minute areas of the cathode to reactivate.

621.385.032.216 **1549**

Note on the Ionic Conductivity of Oxide-Coated Cathodes.—S. Wagener. (*Proc. phys. Soc.*, 1st Dec. 1948, Vol. 61, No. 348, pp. 521–525.)

621.385.83.032.29 **1550**

Design of an Electron Gun, taking account of the Space Charge of the Beam.—H. Huber. (*Ann. Radioélect.*, Jan. 1949, Vol. 4, No. 15, pp. 26–32.) Relations between gun dimensions and electrical parameters are given for an electron beam with high current density and minimum dispersion. Experiments with the gun supplying the beam for a helix-type travelling-wave valve confirm the theory. The gun gives a current of 14 mA at 1 400 V, and after traversing the 28-cm length of the helix the beam current reduction is only 3%.

621.385.832 **1551**

Cathode-Ray Tube with Cylindrical Screen.—A. Pinciroli. (*Atti del Congresso internazionale della Radio, Rome,* Sept./Oct. 1947, pp. 605–629. In Italian.) The essential parts are (*a*) an electron gun, (*b*) an arrangement of electrodes for providing a rotating electric field, (*c*) two trumpet-shaped electrodes between which the beam is deflected at right angles to the tube axis, (*d*) a cylindrical focusing lens, (*e*) two deflecting electrodes to which a voltage proportional to the quantity under observation is applied. The advantages over a c.r. tube using normal cartesian or polar coordinates are: (*a*) extension of the axis of time, which is determined by means of two sinusoidal voltages of lower frequency than that of the quantity under observation, (*b*) two distinct electron beams can be used, (*c*) there is no interaction between deflection electrodes and those which are used to determine the time axis.

621.396.615.14 **1552**

The Resnatron.—G. E. Sheppard. (*Atti del Congresso internazionale della Radio, Rome,* Sept./Oct. 1947, pp. 643–654. In English.) A detailed description of the design and operating principles, with diagrams. The advantages over conventional valves for high-power use at u.h.f. are stressed.

621.396.615.141.2 **1553**

Rising-Sun Magnetrons with Large Numbers of Cavities.—A. V. Hollenberg, N. Kroll & S. Millman. (*J. appl. Phys.*, July 1948, Vol. 19, No. 7, pp. 624–635.) Disturbance from unwanted modes and the critical nature of anode and cathode dimensions prevented satisfactory operation with more than 26 open-end cavity-type vane resonators. Stable π-mode operation of pulsed magnetrons having up to 38 cavities was achieved for $\lambda \approx 1.25$ cm by the use of closed-end resonators. Increasing the number of resonators should enable existing magnetron techniques to be extended to millimetre wavelengths, and the r.f. power obtainable for $\lambda \geqslant 1$ cm to be increased.

621.396.615.141.2 **1554**

The Cavity Magnetron.—J. T. Randall. (*Atti del Congresso internazionale della Radio, Rome,* Sept./Oct. 1947, pp. 630–642. In English.) A review of the experimental development, carried out during the war, at Birmingham University; it includes design and method of construction, design of the h.f. output circuit, and an outline of the underlying theory.

621.396.615.141.2 **1555**

A Magnetron Resonator System.—E. C. Okress. (*Atti del Congresso internazionale della Radio, Rome,* Sept./Oct. 1947, pp. 578–600. In English.) A mathematical investigation of the normal modes of the symmetrical multi-sectional or vane-type magnetron. Graphs and equations enable the modes to be determined from anode-block dimensions. The relationship between the wavelengths for strapped and unstrapped resonator systems is investigated. Tables are given for designing reduced-scale prototypes for use on other wavelengths and voltages.

621.396.615.141.2 **1556**

The Turbator, a Single-Cavity Magnetron.—F. Lüdi. (*Atti del Congresso internazionale della Radio, Rome,* Sept./Oct. 1947, pp. 529–543. In German.) See also 1660 of 1943.

621.396.615.141.2 : [537.291 + 538.691 **1557**

Motion of an Electron in a Cavity Magnetron.—M. Panetti. (*Atti del Congresso internazionale della Radio, Rome,* Sept./Oct. 1947, pp. 601–605. In Italian.) The resonance wavelengths for the different modes are first calculated by Abele's method (3823 of 1947). The electron trajectory is regarded as differing by a small amount from the cycloidal orbit due to uniform e.m. and e.s. fields; equations of motion are given applicable when certain simplifying conditions are satisfied.

621.396.615.142 **1558**

On the Efficiency of Velocity-Modulation Valves.—P. Guénard, R. Warnecke & C. Fauve. (*Ann. Radioélect.*, Oct. 1948, Vol. 3, No. 14, pp. 302–327; erratum, *ibid.*, Jan. 1949, Vol. 4, No. 15, p. 92.) The factors which tend to reduce efficiency are discussed. Methods of correcting imperfections of the form of the electron packets in the 2-cavity type of valve are considered; efficiency can thus be considerably improved. The 3-cavity valve appears to be the most suitable for obtaining high-power output with good efficiency. Calculation shows that an efficiency of the order of 45% is to be expected for wavelengths of 10–20 cm.

621.396.615.142.2 : [537.291 + 538.691 **1559**

Electron Optics of H.F. Valves.—D. Charles. (*Ann. Radioélect.*, Jan. 1949, Vol. 4, No. 15, pp. 33–47.) A description of the electrolyte-tank method of determining electron trajectories is illustrated by results obtained for a reflex klystron. Details are also given of a simple method which makes use of a resistance grid. For systems of cylindrical symmetry the resistances are all equal; for revolution symmetry the resistances are graded. Results obtained are sufficiently accurate for practical design. An analytical method is described which enables corrections for space-charge effects to be applied.

621.396.822 **1560**

Noise in Linear Networks.—Schremp. (*See* 1488.)

MISCELLANEOUS

022.3 : 621.38.001.8 **1561**

The Patent Office Library and Electronics.—R. Neumann. (*Electronic Engng*, Feb. 1949, Vol. 21, No. 252, pp. 52–57.) A general description, with special reference to electronic subjects and the indexing system.

621.396 **1562**

Elektrische Wellen. [Book Review]—W. O. Schumann. C. Hanser Verlag, München, 340 pp. (*Wireless Engr,* Nov. 1948, Vol. 25, No. 302, p. 370.) Based on a course of lectures at Munich University. The treatment is detailed and well illustrated.

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

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ACOUSTICS AND AUDIO FREQUENCIES

534 + 621.395.6 **1563**

1949 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 160–178.) Abstracts are given of the following papers read at the convention:—18. The Reproduction of Sound, by H. F. Olson. 19. New Developments in Studio Design in Europe, by L. L. Beranek. 20. The Technique of Television Sound, by R. H. Tanner. Titles of other papers are given in other sections.

534.13 **1564**

Study, to the Second Approximation, of the Acoustic Transparency of a Rectangular Plate.—T. Vogel. (*Ann. Phys., Paris*, Sept./Oct. 1947, Vol. 2, pp. 502–516.) The discussion of the case of an elastic plate forming a window in an infinite rigid wall and subjected to plane sound waves incident normally (2728 of 1947) is here extended to oblique incidence and vibrations of finite amplitude. The results are applied to the vibration of aircraft structures.

534.21 **1565**

Waves in Compressible Media.—W. Weibull. (*Kungl. tekn. Högsk. Handl., Stockholm*, 1948, No. 18, 38 pp. In English.) General equations of motion are derived and applied to plane, cylindrical and spherical waves. Boundary conditions involving fixed and moving surfaces are considered.

534.232 : 621.313.12 : 538.652 **1566**

Magnetostriction Generators.—Osborn. (*See* 1802.)

534.321.9 **1567**

Propagation of Ultrasonic Waves in Solid Rods.—T. Hüter. (*Z. angew. Phys.*, Jan. 1949, Vol. 1, No. 6, pp. 274–289.) Discussion with special reference to the transmission of ultrasonic energy along rods for medical purposes. Various theories are reviewed. Dispersion and resonance effects are considered and a graphical method of solution of the frequency equation is described. Determination of the cross-sectional distribution of the amplitude of axial displacement affords a new experimental method for velocity measurement.

Experiments showed that in Al rods of diameter 1.5 cm and 1.0 cm respectively, harmonics up to the order 40 could be detected. The use of an initial solid cone to concentrate the energy transmitted along a rod 20 cm long and 1.5 cm in diameter, at a frequency of 780 kc/s, increased the energy density in the rod from 4 W/cm^2 to 7.4 W/cm^2.

534.7 **1568**

Determinations of Ear Fatigue with the Automatic Audiometer.—G. G. Sacerdote. (*Alta Frequenza*, Dec. 1948, Vol. 17, No. 6, pp. 257–264. In Italian, with English, French, and German summaries.) An account of results obtained with an instrument of the type described by G. von Békésy (*Arch. elekt. Übertragung*, 1947, No. 1, p. 13).

534.845 **1569**

Absorption of Sound by Porous Materials : Part 5.—C. Zwikker, J. van den Eijk & C. W. Kosten. (*Physica, 's Grav.*, April 1943, Vol. 10, No. 4, pp. 239–247. In English.) An account of further measurements with systems of glass tubes and with a porous wall, the structure factors of which could be calculated as well as measured. Results confirmed the theory given in part 2. For parts 1–4 see 3322 of 1948.

534.851 : 621.395.813 **1570**

A Study of Frequency Fluctuations in Sound Recording and Reproducing Systems.—P. E. Axon & H. Davies. (*Proc. Instn elect. Engrs*, Part III, Jan. 1949, Vol. 96, No. 39, pp. 65–75.) Discussion of the imperfections arising in the manufacture of gramophones and disks and causing wow. An instrument for measuring total wow is described. By statistical analysis of the results, the sources of wow can be identified and appropriate corrections made.

534.86 : 621.396.61/.62 : 621.395.623.7 **1571**

Fundamental Electroacoustic Principles for the Transmission of a Wide Band of Audio Frequencies.—Furrer, Lauber & Werner. (*See* 1787.)

534.861 : 534.76 **1572**

Duplication of Concerts.—R. Vermeulen. (*Philips tech. Rev.*, Dec. 1948, Vol. 10, No. 6, pp. 169–177.) Stereophonic reproduction, with or without intermediate recording, enables the audience in an overflow auditorium to hear what is claimed to be an exact reproduction of the original music.

621.395.623.7 **1573**

Voigt Permanent-Magnet Loudspeaker.—(*Wireless World*, March 1949, Vol. 55, No. 3, p. 103.) The speaker has a flux density of 18 000 lines/cm^2 in a 1½-mm gap. The magnetomotive force is supplied by a massive centre block of ticonal, with two parallel return paths of large cross-section. Difficulties of alignment or due to inaccurate machining of the gap are overcome by making the pole tip assembly a separate unit. The speech coil impedance is 15 Ω and the total weight 30 lb.

681.85 : 534.43 : 621.395.813 **1574**

High-Fidelity Response from Phonograph Pickup.—E. J. O'Brien. (*Electronics*, March 1949, Vol. 22, No. 3, pp. 118–120.) The main causes of poor performance are briefly considered. Formulae for voltage gain and input admittance, with results for feedback circuits, are given. Input circuits and response curves for several pickups using feedback, and typical response curves for different feedback networks, are illustrated.

534 **1575**

Vibration and Sound. [Book Review]—P. M. Morse. McGraw-Hill, London, 2nd edn, 468 pp., 33s. (*Wireless Engr*, Jan. 1949, Vol. 26, No. 304, p. 38.) Intended primarily as a textbook on the mathematical theory of vibration, for students of physics and communication engineering. The first edition (noted in 3023 of 1937) has been extensively revised to include discussion of modern techniques used in acoustics and a comprehensive treatment of transient phenomena. A sound knowledge of the calculus is assumed.

534.321.9 **1576**

Supersonics — The Science of Inaudible Sounds. [Book Review]—R. W. Wood. Brown University, Providence, R.I., 1939, 162 pp., $2.00. (*J. Franklin Inst.*, Jan. 1949, Vol. 247, No. 1, p. 84.) A historical review of supersonic research. Investigations in the last 15 years are not reported, but the 1939 edition is reprinted with a supplementary bibliography which is " probably the most complete one ever published in this field ".

621.395.625.2 **1577**

Practical Disk Recording. [Book Review]—R. H. Dorf. Gernsback Library No. 39; Radcraft Publications Inc., New York, 96 pp., 75c. (*Electronic Engng*, Feb. 1949, Vol. 21, No. 252, p. 69.) " . . . should prove of great interest and usefulness to beginners and amateur enthusiasts in the sound recording world, to whom it is recommended."

AERIALS AND TRANSMISSION LINES

621.315 + 621.392 + 621.396.67 **1578**

1949 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 160–178.) Abstracts are given of the following papers read at the convention:—7. Elliptically Polarized Radiation from Inclined Slots on Cylinders, by G. Sinclair. 8. Some Properties of Radiation from Rectangular Waveguides, by J. T. Bolljahn. 9. Theory of End-Fire Helical Antennas, by A. E. Marston & M. D. Adcock. 10. A Broad-Band Transition from Coax to Helix, by C. O. Lund. 11. Equivalent Circuits for Coupling of Waveguides by Apertures, by N. Marcuvitz. 22. Wide-Angle Metal-Plate Optics, by J. Ruze. 23. Diffraction Pattern from an Elliptical Aperture, by R. J. Adams & K. S. Kelleher. 24. The Measurement of Current and Charge Distributions on Transmitting and Receiving Antennas, by T. Morita. 25. Antenna Systems for Multichannel Mobile Telephony, by W. C. Babcock & H. W. Nylund. 26. A Low-Drag Aircraft Antenna for Reception on Omnidirectional Range Signals in the 108–122-Mc/s Band, by J. P. Shanklin. 63. A Unidirectional Reversible-Beam Antenna for Twelve-Channel Reception of Television Signals, by O. M. Woodward, Jr. 75. A Magnetostrictive Delay Line, by E. Bradburd. Titles of other papers are given in other sections.

621.315 **1579**

High-Frequency Polyphase Transmission Line.—C. T. Tai. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1949, Vol. 37, No. 1, p. 58.) Correction to 637 of March.

621.315.2 : 621.3.09 **1580**

Diagram for Determining the Propagation Constant [for a cable].—E. B. B. di Sambuy. (*Alta Frequenza*, Dec. 1948, Vol. 17, No. 6, pp. 274–279. In Italian.)

621.315.212 : 621.397.743 **1581**

Coaxial Cable Joins East and Mid-West TV Networks.—R. Hertzberg. (*Tele-Tech*, Feb. 1949, Vol. 8, No. 2, pp. 18–20, 55.) The cable links Philadelphia, Pittsburgh and Cleveland. Each cable has 8 individual lines, four being for telephone services ; each television circuit has two lines, one being a spare.

621.315.65 **1582**

A Coaxial-Line Support for 0 to 4 000 Mc/s.—R. W. Cornes. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1949, Vol. 37, No. 1, pp. 94–97.) The design of a broad-band undercut support is discussed, based on a slowly changing image impedance of the bead, so that this differs only slightly from the line impedance up to some maximum frequency. A typical microwave application is described which has a voltage s.w.r. less than 1.025 up to 4 000 Mc/s.

621.392.2 : 621.385 **1583**

Study of the Propagation of an Electromagnetic Wave in the Presence of Two Electron Beams of Neighbouring Velocities.—P. Lapostolle. (*C. R. Acad. Sci., Paris*, 28th Feb. 1949, Vol. 228, No. 9, pp. 753–754.) Theory is given for an arrangement consisting of a transmission line, in which the propagation velocity may have any value whatever, and two concentric electron beams of neighbouring velocities. One beam, e.g. the external one, permits the propagation of waves whose velocity is near that of the electrons ; the other beam, starting off with the velocity of one of the preceding waves, causes the appearance of another wave which increases exponentially.

621.392.26† **1584**

Wave Guides for Slow Waves.—L. Brillouin. (*J. appl. Phys.*, Nov. 1948, Vol. 19, No. 11, pp. 1023–1041.) " Boundary conditions are obtained for structures with very narrow slots, either closed or open, and a general method of solution of the wave equations is discussed. Fields in the free region and in the slot region are expanded in convenient Fourier series and these series joined along the border of both regions. In doing this, it can be proved that the field contains a dominant term, completed by corrections that represent the field distortion near the open end of the slots. Under favorable conditions, and for very narrow slots, the dominant terms are by far the most important. This allows for a simplified discussion of a variety of examples." See also 1253 of 1948 (Chu & Hansen).

621.392.26† **1585**

Diffraction and Perturbation in a Waveguide due to an Electromagnetic Wave.—T. Kahan. (*J. Phys. Radium*, Nov. 1945, Vol. 6, No. 11, pp. 300–301.) Formulae are derived, in the form of series, for the electric field within a cylindrical waveguide and for the diffraction field outside it produced by an external plane wave incident normally to the waveguide axis.

621.392.26† : 621.396.67 **1586**

Laterally-Displaced Slot in Rectangular Waveguide.—A. L. Cullen. (*Wireless Engr*, Jan. 1949, Vol. 26, No. 304, pp. 3–10.) The admittance presented by a resonant slot cut in the top face of a rectangular waveguide and offset from the centre of the face is calculated by a simple application of transmission-line theory. The Q of such a slot is calculated and it is shown that slots designed for a broad-band system should be as wide as possible. The phase of the radiation from the slot at resonance is independent of the amount of offset and bears a fixed relation to the phase of the field in the guide at the centre of the slot. The effect of a small deviation from resonance is considered. Experimental results agree very well with the theory.

621.396.67 **1587**

Physical Limitations of Omni-Directional Antennas.—L. J. Chu. (*J. appl. Phys.*, Dec. 1948, Vol. 19, No. 12, pp. 1163–1175.) The directivity gain G and the Q of such aerials are calculated in terms of spherical wave functions under idealized conditions. Alternative criteria for optimum performance are (*a*) maximum G for a given complexity of the aerial structure, (*b*) minimum Q, (*c*) maximum G/Q. An aerial of maximum dimension $2a$ can have broad bandwidth provided that $G \leqslant 4a/\lambda$. As G increases beyond this value, Q increases rapidly. The aerial which has potentially the broadest bandwidth has a radiation pattern corresponding to that of an infinitesimally small dipole.

621.396.67 **1588**

On the Theory of Biconical Antennas.—C. T. Tai. (*J. appl. Phys.*, Dec. 1948, Vol. 19, No. 12, pp. 1155–1160.) Discussion of the work of Schelkunoff (1049 of 1942 and 852 of 1946) and Smith (644 of March). Smith's expressions are extended to derive, for small-angle cones, an expression for the effective load admittance which is the same as that which Schelkunoff derived by other methods. Smith's results are not valid for large-angle cones. The advantages of the method over Schelkunoff's are demonstrated by deriving the characteristics of a biconical aerial where the space between the cones is filled with a dielectric other than air.

621.396.67 **1589**

Properties of a Long Antenna.—E. Hallén. (*J. appl. Phys.*, Dec. 1948, Vol. 19, No. 12, pp. 1140–1147.) Well-known integral expressions for the outgoing current waves are transformed into series expansions valid for all distances from the feeding point; results thus obtained are shown graphically.

621.396.67 **1590**

The Received Power of a Receiving Antenna and the Criteria for its Design.—Yung-Ching Yeh. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 155–158.) A general formula for the received power is derived. Two theorems which can be used as design criteria are deduced.

621.396.67 : 517.54(083.5) **1591**

Iterated Sine and Cosine Integrals.—Hallén. (*See* 1702.)

621.396.67 : 538.569 **1592**

Surface Currents on a Conducting Sphere Excited by a Dipole.—C. H. Papas & R. King. (*J. appl. Phys.*, Sept. 1948, Vol. 19, No. 9, pp. 808–816.) Curves of the real and imaginary parts of the surface currents are given for the case of a $\lambda/2$ dipole erected on the surface of the sphere, for various radii of the sphere.

621.396.67 : 621.396.9 **1593**

A Solution of the Problem of Rapid Scanning for Radar Antennae.—R. F. Rinehart. (*J. appl. Phys.*, Sept. 1948, Vol. 19, No. 9, pp. 860–862.) The theory of parallel-plate waveguides was used by Myers (2679 of 1947) to design an aerial for rapid scanning, but the illumination properties of this aerial were unsatisfactory. A plane optical system with variable index of refraction can satisfy the requirements. By a suitable transformation, a surface of revolution of constant refractive index can be found whose optical properties are the same as those of the plane system. This surface provides an apparently practicable solution of the scanning problem. The diameter of the feed circle can be made arbitrarily small by judicious use of an ellipsoidal reflector.

621.396.67 : 621.396.931 **1594**

Flush-Mounted Antenna for Mobile Application.—D. R. Rhodes. (*Electronics*, March 1949, Vol. 22, No. 3, pp. 115–117.) A small annular-slot aerial with the same radiation pattern as a dipole, and which can be used in the metal roof of a car. Theory and performance are discussed.

621.396.67 : 621.396.97 **1595**

Multi-V Antenna for F.M. Broadcasting.—M. W. Scheldorf. (*Electronics*, March 1949, Vol. 22, No. 3, pp. 94–96.) Folded dipoles are bent into V-shape to form a light-weight array that can be mounted on top of existing a.m. aerials. The array is tuned by extensions on each arm, without seriously changing the impedance match and radiation pattern.

621.396.67.029.63 : 621.392.43 **1596**

The Design of Wide-Band Aerial Elements for 500–600 Mc/s Ground Radar.—C. H. Westcott & F. K. Goward. (*Proc. Instn elect. Engrs*, Part III, Jan. 1949, Vol. 96, No. 39, pp. 41–51.) Smith's circle diagrams are used to enable the matching of aerials with parabolic reflectors to feeders to be effected by means of a system of series and parallel stubs. Systems are described in which impedance changes in the stubs compensate for the impedance changes in the aerial system as the frequency is varied.

621.396.671 **1597**

On Antenna Impedances.—E. Hallén. (*Kungl. tekn. Högsk. Handl., Stockholm*, 1947, No. 13, 18 pp. In English.) Formulae given for the current in and impedance of a straight, symmetrical, centre-fed aerial contain asymptotic series, and the importance of the smaller terms of these series is discussed. Coefficients of the second-order terms are expressed in a new form and are tabulated as functions of the aerial length.

621.396.671 **1598**

Radiation Impedance and Aerial Shortening of the Transmitter Dipole.—J. Müller-Strobel. (*Bull. schweiz. elektrotech. Ver.*, 30th Nov. 1946, Vol. 37, No. 24, pp. 710–714. In German, with French summary.) The theory of forced oscillations is applied to the case of the transmitter dipole (*a*) neglecting and (*b*) taking account of aerial losses. Derivation of the formulae used is given in papers mentioned in the references and is omitted here. Calculated values are in good agreement with the results of measurements on a bronze wire supported by a balloon.

621.396.671 **1599**

An Experimental Investigation of Formulas for the Prediction of Horn Radiator Patterns.—G. A. Woonton, D. R. Hay & E. L. Vogan. (*J. appl. Phys.*, Jan. 1949, Vol. 20, No. 1, pp. 71–78.) Measured E-plane radiation patterns give satisfactory agreement with the well-known Kirchhoff formula for angles up to 20° and distances as short as 1 ft from the horn mouth; H-plane measurements agree less well. Distant patterns are compared with the Stratton & Chu corrected formula (3875 of 1939).

621.396.671 **1600**

Gains and Effective Areas of Horn Antennas.—R. B. Watson & C. M. McKinney. (*J. appl. Phys.*, Oct. 1948, Vol. 19, No. 10, pp. 871–876.) A reciprocity method is described for determining absolute gain. An alternative method is used to obtain both gain and effective area by comparison of experimental and theoretical radiation patterns; results thus obtained are in satisfactory agreement with values obtained by the reciprocity method.

621.396.671 **1601**

Parasitic-Array Patterns.—J. L. Gillson. (*QST*, March 1949, Vol. 33, No. 3, pp. 11–15, 104.) Patterns determined experimentally are presented for a 3-element array adjusted both for maximum forward and minimum rear radiation at several heights, and for a 2-element array at a height of $5\lambda/4$ with various lengths of the parasitic element.

621.396.671 **1602**

On the Calculation of Radiation Patterns of Dielectric Rods.—R. B. Watson & C. W. Horton. (*J. appl. Phys.*, Sept. 1948, Vol. 19, No. 9, pp. 836–837.) Continuation of 1297 of May. The equivalent currents may be expressed in terms of travelling waves without appreciably changing the computed radiation patterns.

621.396.677 **1603**

Design of Yagi Aerials.—R. M. Fishenden & E. R. Wiblin. (*Proc. Instn elect. Engrs*, Part III, Jan. 1949, Vol. 96, No. 39, pp. 5–12.) An account of work done at the Telecommunications Research Establishment between 1938 and 1942. Discussion of: (*a*) advantages and limitations of multiple arrays, (*b*) the mode of operation of a Yagi aerial, (*c*) the effect on the polar diagram of changing parameters. Only aerials of length $>\lambda$ are considered; these normally consist of 3 or more directors in addition to an exciter and a reflector. Sufficient information is tabulated for approximate design of an aerial of given characteristics. See also 1348 of 1947 (Walkinshaw) and 1349 of 1947 (Reid).

621.396.677 **1604**

Dielectric Directive Radiators.—P. Mallach. (*Fernmeldetech. Z.*, Feb. 1949, Vol. 2, No. 2, pp. 33–39.) Discussion of the polar diagrams of uniform and tapered dielectric rods and of arrays of such rods. Design theory is presented; experimental results are in excellent agreement.

621.396.677.029.54 **1605**

Design Considerations for Directive Antennae-Arrays at Medium-Wave Broadcast Frequencies, taking into account the Final Radio-Frequency Amplifier Circuits.—J. C. Nonnekens. (*HF, Brussels*, 1949, No. 1, pp. 26–31. In English.) The horizontal directivity of broadcasting arrays is briefly reviewed and the power distribution, as determined from the impedance at the base of the aerial, is calculated. The general case of vertical aerials of unequal heights, with mutual inductance, is analysed and measurement methods are outlined. The practical design of 4-terminal networks for matching and power distribution is considered. Difficulties due to parallel capacitance in the case of towers with high base impedance are discussed, and possible antiparasitic devices for inclusion in the final amplifier are mentioned.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.018.7 **1606**

Pulse-Sinewave Converter.—W. M. Cameron. (*Electronics*, March 1949, Vol. 22, No. 3, pp. 174..180.) A pulse input produces a positive and a negative exponential wave which are folded to produce a wave of approximately sinusoidal characteristics. Design and performance are discussed and a typical 2-valve circuit illustrated, in which a 30-V pulse input provides a 17-V peak-to-peak sinusoidal output of low harmonic content.

621.314.2.029.3 : 621.317.784 **1607**

Audio Frequency Transformer Design. — C. F. Brockelsby. (*Marconi Rev.*, Jan./March 1949, Vol. 12, No. 92, pp. 1–11.) Analysis for the transformer of a wide-range a.f. absorption wattmeter.

621.316.726.078.3 : 621.396.615.142.2 : 538.569.4 **1608**

Frequency Stabilization of Microwave Oscillators by Spectrum Lines : Part 2.—J. L. G. de Quevedo & W. V. Smith. (*J. appl. Phys.*, Sept. 1948, Vol. 19, No. 9, pp. 831–836.) "The design of both narrow band high stabilization and broad band lower stabilization spectrum-line discriminators is developed in a generalized form applicable to various spectrum lines and cavity designs. Comparison with experiment is made for two broad band discriminators utilizing the NH_3 3,3-absorption line at 23 870 Mc/s as the frequency determining element. These discriminators, used with an amplifier of 2 000 gain, reduce drifts by factors of 250 and 1 000 respectively, compared to an unstabilized tube." Part 1, 2180 of 1948.

621.318.572 : 518.5 **1609**

Rectifier Networks for Multiposition Switching.—D. R. Brown & N. Rochester. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 139–147.) 1948 I.R.E. National Convention paper. For computers and other applications where switching times $<1\ \mu$s are required. Various types of network, including that using the minimum number of rectifiers, are discussed. Generalized equivalent circuits are derived.

621.318.572 : 621.396.822 **1610**

Spurious Signals Caused by Noise in Triggered Circuits.—Middleton. (*See* 1777.)

621.319.4 : 551.57 : 621.317.335 **1611**

The Effect of Humidity on the Calibration of Precision Air Capacitors.—L. H. Ford. (*Proc. Instn elect. Engrs*, Part III, Jan. 1949, Vol. 96, No. 39, pp. 13–16.) See 978 of April.

621.39 **1612**

1949 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 160–178.) Abstracts are given of the following papers read at the convention:—Symposium on Network Theory, comprising (*a*) Modern Developments in the Topology of Networks, by R. M. Foster, (*b*) A Survey on the Status of Linear Network Theory, by E. A. Guillemin, (*c*) Recent Developments in Broad-Band Active Networks, by J. G. Linvill, and (*d*) General Review of Linear Varying-Parameter and Nonlinear Circuit Analysis, by W. R. Bennett. 27. A Method of Synthesizing the Resistor-Capacitor Lattice Structure, by J. L. Bower, J. T. Fleck & P. F. Ordung. 28. Exact Design of Bandpass Networks using n Coupled Finite-Q Resonant Circuits ($n = 3$ and 4), by M. Dishal. 29. Network Approximation in the Time Domain, by W. H. Huggins. 30. The Design of Frequency-Compensating Matching Sections, by V. Rumsey. 31. Amplifier Synthesis through Conformal Transformations, by D. L. Trautman, Jr, & J. M. Pettit. 47. Impedance Curves for Two-Terminal Networks, by E. L. Michaels. 48. An Analysis of Triple-Tuned Coupled Circuits, by N. W. Mather. 49. The Bridged Parallel-Tee Network for Suppressed-Carrier Servo Systems, by C. F. White. 50. Transient Response of Linear Networks with Amplitude Distortion, by M. J. Di Toro. 52. Subminiaturization of I.F. Amplifiers, by G. Shapiro & R. L. Henry. 53. New Applications of a Four-Terminal Titanate Capacitor, by A. A. Pascucci. 54. Frequency-

Control Units, by A. E. Miller. 55. The Type 5811 and Type 5807 Tubes—the Smallest Commercial Pentode Amplifiers, by L. G. Hector & H. R. Jacobus. 68. *G* Curves as an Aid in Circuit Design, by K. A. Pullen. 69. A Direct-Coupled Amplifier employing a Cross-Coupled Input Circuit, by J. N. Van Scoyoc & G. F. Warnke. 70. Annular Circuits for High-Power Multiple-Tube Generators at V.H.F. and U.H.F., by D. H. Preist. 71. Considerations on Electronic Multicouplers, by W. R. Aylward & E. G. Fubini. 74. Speed of Electronic Switching Circuits, by E. M. Williams & D. F. Aldrich. 76. An Electromechanical Strain-Gage Multiplier, by C. H. Woods, E. St. George, L. Isenberg & A. C. Hall. 86. A High-Efficiency Sweep Circuit, by B. M. Oliver. 93. High-Power Sawtooth Current Synthesis from Square Waves, by H. E. Kallmann. 94. Comparison of the LC Toroidal Filter with the Parallel-Tee Feedback-Amplifier Filter, by A. J. Stecca. 95. A Peak-Selector Circuit, by M. J. Parker. 96. A Low-Frequency Synchronized Sawtooth Generator providing Constant Amplitude Sweep with Aperiodic Synchronization Input, by P. Yaffee. 97. Regenerative Amplifiers, by Y. P. Yu. 98. A Rectifier Filter Chart, by R. Lee. 121. Aspects of Double-Stream Amplifiers, by J. R. Pierce; W. B. Hebenstreit; A. V. Hollenberg. 135. An Analysis of Oscillator Performance under Varying Load Conditions and an Electronic System for Automatic Load Compensation, by E. Mittelmann. 136. Low-Power Wide-Tuning-Range U.H.F. Oscillators, by F. J. Kamphoefner & J. M. Pettit. 137. Reactance-Tube Modulation of Phase-Shift Oscillators, by F. R. Dennis & E. P. Felch. 138. A Low-Distortion Audio-Frequency Oscillator, by C. W. Clapp & C. L. Hackley. 139. An Automatic-Frequency-Control System for Mechanically Tuned Oscillators, by J. G. Stephenson. Titles of other papers are given in other sections.

621.392 **1613**

The Duality between Interlinked Electric and Magnetic Circuits and the Formation of Transformer Equivalent Circuits.—E. C. Cherry. (*Proc. phys. Soc.*, 1st Feb. 1949, Vol. 62, No. 350B, pp. 101–111.) Discussion of the conditions under which equivalent circuits exist for circuits containing impedances and transformers, and of rules for the formation of equivalent circuits. A physically realizable equivalent circuit does not exist if the given magnetic circuit is non-planar. Under certain conditions the process may be reversed and the impedances in a circuit may be coupled by a suitable transformer so that the various current and voltage constraints are unaltered.

621.392 **1614**

Properties of some Wide-Band Phase-Splitting Networks.—D. G. C. Luck. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 147–151.) Discussion of passive networks producing polyphase output from single-phase input. The properties of simple branch circuits are considered, and an expression is derived for the phase difference produced between branches, as a function of frequency. This expression facilitates direct circuit design from required performance. General performance and design curves are included.

621.392 **1615**

Thévenin's Theorem.—" Cathode Ray ". (*Wireless World*, March 1949, Vol. 55, No. 3, pp. 109–112.) A simple explanation, with applications to various network calculations.

621.392.43 : 621.396.67.029.63 **1616**

The Design of Wide-Band Aerial Elements for 500-600 Mc/s Ground Radar.—Westcott & Goward. (*See* 1596.)

621.392.52 **1617**

Transmission-Line Filters.—E. K. Sandeman. (*Wireless Engr*, Jan. 1949, Vol. 26, No. 304, pp. 11–25.) The discussion is limited to filters using transmission lines whose loss is negligible and whose lateral dimensions are small compared with λ. The treatment is thus not normally applicable to waveguides. Three general types of filter are considered: (*a*) lengths of line shunt-loaded with short-circuited or open-circuited stubs consisting of lengths of the same type of line, (*b*) lengths of line series-loaded with short-circuited or open-circuited stubs, and (*c*) two electrically unequal lengths of the same type of line in parallel. Although the image impedances are different, the pass bands of filter sections constituted by lines shunt-loaded with shorted stubs are the same as those of lines series-loaded with open stubs. Similarly the pass bands of lines shunt-loaded with open stubs are the same as those of lines series-loaded with shorted stubs. The relevant formulae are developed, using matrix theory. Pass and attenuating bands are shown graphically.

621.392.52 **1618**

Filters and Filter Problems.—F. Locher. (*Bull. schweiz. elektrotech. Ver.*, 21st Sept. 1946, Vol. 37, No. 19, pp. 559–568. In German, with French summary.) General discussion of the present state of the art.

621.392.52 : 621.392.26† **1619**

Paralleled-Resonator Filters. —J. R. Pierce. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 152–155.) Discussion of microwave filters in which input and output waveguides are connected by a number of resonators, each coupled directly to both waveguides. Signal components of different frequencies can pass from the input to the output largely through different resonators. An experimental filter is described.

621.396.611.1 **1620**

Resonance Curves of Forced Oscillations excited by Disturbances with Frequency-Dependent Amplitude.—M. Päsler. (*Ann. Phys., Lpz.*, 20th Sept. 1948, Vol. 4, Nos. 1/2, pp. 1–13.) Discussion for a mechanical oscillatory system subjected to a force whose amplitude is proportional to the *n*th power of the frequency. Results are given for $n = 0, 1 \ldots 4$. The analysis can be applied to oscillations in an electrical circuit.

621.396.611.4 **1621**

On the Excitation and Coupling of Cavity Resonators.—J. Bernier. (*Ann. Radioélect.*, Jan. 1949, Vol. 4, No. 15, pp. 3–11.) Starting from Maxwell's equations, methods of exciting and of coupling cavities by means of conduction currents in loops or probes are discussed, and also the interaction of cavities with periodic convection currents due to electron beams traversing the cavities. The results of Bethe (706 of 1945) for diffraction by small holes are applied to (*a*) the excitation of a cavity by an e.m. field entering the cavity through a circular hole, and (*b*) the coupling of two cavities by a circular hole in their common wall. Practical formulae are given which allow numerical calculation for cases in which the relative value of the e.m. field in an ideal cavity, with neither loop, probe, hole nor electron beam, is known in the neighbourhood of the point where the excitation or coupling device is to be located.

621.396.611.4 : 621.317.336 **1622**

On the Measurement of Cavity Impedance.—Hansen & Post. (*See* 1719.)

621.396.615 : 621.385.029.63/.64 **1623**

Travelling-Wave Valves as Oscillators with Wide-Band Electronic Tuning.—Doehler, Kleen & Palluel. (*See* 1830.)

621.396.615.029.3 **1624**

Study of a RC Audio-Frequency Oscillation Generator.—E. Divoire. (*HF, Brussels*, 1949, No. 1, pp. 5–15. In French.) Theory is given for the Wien-bridge oscillator with automatic regulation by means of a small incandescent lamp. If the components of the bridge and its associated amplifier are suitably chosen, such oscillators can have purity and stability characteristics at a.f. comparable or even superior to those of resonant-circuit oscillators. Experimental results confirm the theoretical calculations.

621.396.615.17 : 621.317.755 **1625**

The Miller Time Base.—B. H. Briggs. (*R.S.G.B. Bull.*, June 1947, Vol. 22, No. 12, pp. 198–202.) Discussion of the basic circuit and various derivatives.

621.396.645 **1626**

Square-Wave Analysis of Compensated Amplifiers.—P. M. Seal. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1949, Vol. 37, No. 1, pp. 48–58.) The theoretical response of a single-stage compensated video amplifier to square-wave and sinusoidal inputs is found. H.f. compensation is obtained by a shunt peaking coil, and l.f. compensation by a RC network, in series with the anode load resistance. Output wave shapes for typical operating conditions are shown. Experimental verification has been obtained for a l.f. amplifier.

621.396.645 **1627**

Theory of the Superregenerative Amplifier.—L. Riebman. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1949, Vol. 37, No. 1, pp. 29–33.) A very general solution is obtained mathematically for the superregenerative circuit, by regarding it as an oscillatory circuit which includes a resistance varying with time from a positive to a negative value. An ideal control-voltage waveform is deduced, approximations to which may be obtained in practice. For this waveform the minimum realizable static bandwidth is 0.89 times the control frequency.

621.396.645 **1628**

Design of Resistance-Capacity Coupled Amplifiers.—H. Mayr. (*Microtecnic, Lausanne*, Dec. 1948, Vol. 2, No. 6, pp. 245–248. In English.) Theoretical analysis using an equivalent circuit, applicable to such amplifiers of any bandwidth and centre frequency. The impedance of by-pass capacitors is neglected ; a correction for this can be made.

621.396.645 **1629**

Amplifier Problems for Ultra-Short Waves.—W. Sigrist. (*Bull. schweiz. elektrotech. Ver.*, 12th Jan. 1946, Vol. 37, No. 1, pp. 5–22. In German, with French summary.) A detailed examination of the relations between electron beam concentration and valve geometry and construction, as affecting amplification factor, limiting wavelength and efficiency.

621.396.645 : 621.385.032.24 **1630**

Practical Notes on Grid Current and Neutralisation.—Dickson. (*See* 1831.)

621.396.645.029.62/.63 : 621.396.822 **1631**

On the Reduction of the Effect of Spontaneous Fluctuations in Amplifier Valves for Metre and Decimetre Waves.—M. J. O. Strutt & A. van der Ziel. (*Physica, 's Grav.*, Dec. 1943, Vol. 10, No. 10, pp. 823–826. In German.) Further discussion, with special reference to the optimum detuning of the input circuit of an amplifier. For long abstract of main paper, see 749 of 1945.

621.396.662.029.64 : 621.315.61 **1632**

Attenuator Materials for Microwaves.—Teal, Rigterink & Frosch. (*See* 1691.)

621.396.69 + 621.317.7 **1633**

Standardised Super High-Frequency Components and Instruments.—(*Engineer, Lond.*, 4th Feb. 1949, Vol. 187, No. 4854, pp. 143–144.) Special matching features are incorporated to prevent confusion; female types of connection are used for power outputs and male for power inputs. Wavemeters, attenuators, bolometers, matching stubs, crystal units, adjustable loop probes, fixed probes, tuning plungers and connectors are all briefly discussed.

621.396.69 **1634**

1949 Components Exhibition, Paris.—(*Radio prof., Paris*, Feb. 1949, Vol. 18, No. 170, pp. 16–23, 25; *Toute la Radio*, April 1949, Vol. 16, No. 134, pp. 115–122; *T.S.F. pour Tous*, March & April 1949, Vol. 25, Nos. 245 & 246, pp. 99–101 & 143–146.) Descriptions of novelties and exhibits of particular interest or merit.

621.397.645 **1635**

On the Design of Television Intermediate-Frequency Amplifiers.—J. Sokolov. (*Bull. schweiz. elektrotech. Ver.*, 24th Aug. 1946, Vol. 37, No. 17, pp. 509–514. In German, with French summary.) A very wide pass band is required and the phase variation of the signal with frequency should be as nearly linear as possible. Taking these conditions into account, the necessary formulae for complete design calculations are deduced; a numerical example is given.

621.392.029.64 **1636**

Principles of Microwave Circuits. [Book Review]—C. G. Montgomery, R. H. Dicke & E. M. Purcell (Eds). McGraw-Hill, London, 486 pp., 36s. (*Wireless Engr*, Jan. 1949, Vol. 26, No. 304, p. 37.) Vol. 8 of the M.I.T. Radiation Laboratory series. The field equations of waveguides are discussed very generally; waveguide elements (irises etc.) and cavities are considered. Much space is given to the matrix algebra of the general network and to equivalent network theory. See also 1016 of April (Ragan).

621.396 : 518.3 **1637**

Technische Nomogramme. [Book Review]—H. J. Schultze. Ingenieurbüro für Nomographie und Fernmeldetechnik, München, 1948, 71 nomograms, 26 DM. (*Elektron Wiss. Tech.*, Feb. 1949, Vol. 3, No. 2, p. 88.) Abacs for calculations relating to oscillatory circuits, filters, amplifiers, transformers, coils, tracking, etc.

621.396.645 **1638**

Vacuum Tube Amplifiers. [Book Review]—G. E. Valley, Jr, & H. Wallman (Eds). McGraw-Hill, London, 743 pp., £3. (*Wireless Engr*, Jan. 1949, Vol. 26, No. 304, pp. 37–38.) Vol. 18 of the M.I.T. Radiation Laboratory series. The book necessarily includes much well-known material, but also contains much not previously published, such as pulse-response curves of band-pass amplifiers and some items concerning d.c. amplifiers. The treatment is essentially practical.

GENERAL PHYSICS

53 **1639**

1949 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 160–178.) Abstracts are given of the following papers read at the convention :—Symposium on Nuclear Science, comprising (*a*) The Fundamental Particles, by D. J. Hughes, (*b*) The Detection and Measurement of Nuclear Radiation, by H. L. Andrews, (*c*) The Effects of Ionizing Radiation on Tissue, by J. P. Cooney, and (*d*) The Application of Nuclear Radiation to Industry, by J. R. Menke. 90. Geometrical Representation of the Polarization of a Plane Electromagnetic Wave, by G. A. Deschamps. 122. On the Theory of Axial Symmetric Electron Beams in an Axial Magnetic Field, by A. L. Samuel. 123. Electron Beams in Axial Symmetric Magnetic and Electric Fields, by C. C. Wang. Titles of other papers are given in other sections.

53.081 + 621.3.081 **1640**

Some Units in the Giorgi System and the C.G.S. System.—E. Hallén. (*Kungl. tekn. Högsk. Handl., Stockholm*, 1947, No. 6, 44 pp. In English.) In the Giorgi system, corresponding electric and magnetic quantities have dimensions differing by a velocity. All factors of conversion to the Sommerfeld c.g.s. system are powers of 10, and are tabulated.

537.521 **1641**

Electronic Interaction in Electrical Discharges in Gases.—J. H. Cahn. (*Phys. Rev.*, 15th Jan. 1949, Vol. 75, No. 2, pp. 293–300.)

537.523.3 : 621.396.823 **1642**

Radio Influence from High-Voltage Corona.—Slemon. (*See* 1780.)

537.523.4.029.64 **1643**

Oscillographic Observations on Ultra-High-Frequency Sparks.—W. A. Prowse & W. Jasiński. (*Nature, Lond.*, 15th Jan. 1949, Vol. 163, No. 4133, pp. 103–104.) Tracings show the collapse of field in a resonator energized at 2 800 Mc/s, during breakdown of irradiated hydrogen, nitrogen and oxygen at atmospheric pressure in a 1.4-cm gap. With mid-gap irradiation, abruptness of breakdown is comparable to that with d.c. Breakdown stress is independent of rate of voltage rise and location of irradiation. See also 361 of February (Cooper & Prowse).

537.525 : 538.551.25 **1644**

Plasma-Electron Oscillations.—T. R. Neill. (*Nature, Lond.*, 8th Jan. 1949, Vol. 163, No. 4132, pp. 59–60.) Experiments using a specially designed tube with a straight wire filament and movable probes confirm the existence of plasma-electron vibrations and v.m. of primary electron beams passing through a small volume close to the cathode, as suggested by Armstrong (2506 of 1948). The relationship between the bunching parameter $V^{\frac{3}{2}}\lambda/I$ and the bunching distance d has approximately the linearity predicted by Webster (968 of 1940) in a particular case, V being the tube voltage, λ the vacuum wavelength of the oscillations and I the amplitude of response of the resonator with the probe at the bunching point.

538.3 : 517.54 **1645**

Application of Conformal Representation to Wave Fields.—H. H. Meinke. (*Z. angew. Phys.*, Jan. 1949, Vol. 1, No. 6, pp. 245–252.) By means of conformal representation, the inhomogeneous plane wave between two surfaces of relatively general form is transformed into a plane wave between two parallel planes with an intervening inhomogeneous dielectric. Maxwell's equations for this wave then give an infinite system of linear differential equations of the second order with an infinite number of unknown functions of a variable. Convergence considerations for these functions show that the problem can be treated with sufficient accuracy with only two functions. This makes it possible to develop a systematic step-by-step approximation method for the wave field of such inhomogeneous systems, starting from the e.s. field, which in most cases is a satisfactory first approximation.

538.3 : 531.314.2 **1646**

An Extension of Lagrange's Equations to Electromagnetic Field Problems.—P. D. Crout. (*J. appl. Phys.*, Nov. 1948, Vol. 19, No. 11, pp. 1007–1019.) If in a given problem a sufficiently close approximation to the instantaneous electric field can be obtained by a linear combination of chosen 'current modes', whose coefficients are functions of time and of generalized coordinates, then Lagrange's equations are satisfied if the kinetic and potential energies are replaced by the magnetic and electric energies respectively. In certain cases the generalized coordinates can be considered as charges which have flowed around the various meshes of a lumped network whose Kirchhoff voltage equations are identical with the Lagrange equations. This lumped network is therefore an equivalent network whose accuracy depends on the current modes chosen. The method has been applied to the design of complex echo boxes ; other h.f. applications are indicated.

538.566.029.64 : 53.087.3 **1647**

Experiments in Electromagnetic Optics.—H. Carrara, P. Checcucci & M. Schaffner. (*Alta Frequenza*, Dec. 1948, Vol. 17, No. 6, pp. 243–256. In Italian, with English, French and German summaries.) A description of apparatus and methods for observation of interference, circular polarization and double refraction with centimetre waves.

549.211 : 537.533.8 : 537.525.92 **1648**

Space Charge Effects in Bombardment Conductivity through Diamond.—R. R. Newton. (*Phys. Rev.*, 15th Jan. 1949, Vol. 75, No. 2, pp. 234–246.) A tentative theory is given and found to agree reasonably well with experiment. Suggestions for future work are included.

621.39.001.11 : 621.396.822 **1649**

Communication in the Presence of Noise.—C. E. Shannon. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1949, Vol. 37, No. 1, pp. 10–21.) Messages and the corresponding signals are represented geometrically as points in two 'function spaces'. The modulation process is regarded as a mapping of one space into the other. Results concerning expansion and compression of bandwidth and the threshold effect are deduced. Formulae are found for the maximum rate of transmission of binary digits over a system subject to various types of noise. Ideal systems which transmit at this maximum rate are discussed. The number of binary digits necessary for satisfactory transmission of a continuous source is also calculated. See also 1361 of May.

621.396.029.64 : 53 **1650**

The Physical Applications of Microwaves.—J. B. Birks. (*J. Brit. Instn Radio Engrs*, Jan. 1949, Vol. 9, No. 1, pp. 10–28.) Discussion of : (*a*) the principles and experimental methods used in the study of e.m. properties of materials at microwavelengths, (*b*) the dielectric properties of solids and liquids, including polar solutions, (*c*) the magnetic properties of solids, and (*d*) the absorption spectra of gases.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.7 **1651**

Recent Results of Solar Investigations.—W. Menzel. (*Elektron Wiss. Tech.*, Feb. 1949, Vol. 3, No. 2, pp. 55–61.) Solar problems still unsolved include the origin of sunspots, their magnetic fields and relatively regular period, the general solar magnetic field, and solar r.f. radiation.

523.72 **1652**

1949 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 160–178.) Abstracts are given of papers read at the convention, including:—89. On the Origin of Solar Radio Noise, by A. V. Haeff. Titles of other papers are given in other sections.

523.746 + 523.72 **1653**

Sunspots, Radio-Fading, and Radio-Noise.—H. Spencer Jones. (*Not. Proc. roy. Instn*, 1948, Vol. 33, No. 153, pp. 637–648.) Discussion of the nature and characteristics of sunspots, flares, etc. and their association with magnetic storms and r.f. solar radiation. The importance of the solar corona is emphasized.

523.746 : 550.385 **1654**

Giant Sunspot and Geomagnetic Storm.—(*Nature, Lond.*, 5th Feb. 1949, Vol. 163, No. 4136, pp. 203–204.) A bipolar group of sunspots of size 2 300 millionths of the sun's hemisphere had central meridian passage on 22nd Jan. 1949. A severe magnetic storm associated with aurora began suddenly on 24th Jan. There is so far little evidence of any large associated solar flare.

538.12 : 521.15 **1655**

Magnetic Fields of the Heavenly Bodies.—H. von Klüber. (*Elektron Wiss. Tech.*, Feb. 1949, Vol. 3, No. 2, pp. 45–54.) General discussion, with special reference to the Zeeman effect, sunspot phenomena, magnetic field of the sun and of the fixed stars, and Blackett's theory (3112 of 1947).

550.38 : 521.15 **1656**

Non-Uniformity of the Earth's Rotation and Geomagnetism.—W. M. Elsasser. (*Nature, Lond.*, 5th March 1949, Vol. 163, No. 4140, pp. 351–352.) Study of the secular variation of the earth's magnetic field suggests that the loss of, and irregularities in, the angular momentum of the earth are due to changes in the liquid core, rather than to the frictional effect of oceanic tides.

550.385 : 523.746.5 **1657**

On the Variation, during the Solar Cycle, of the Period and Extent of the Recurrence of Magnetic Storms.—É. Thellier & O. Thellier. (*C. R. Acad. Sci., Paris*, 21st Feb. 1949, Vol. 228, No. 8, pp. 701–703.) Magnetic storms with sudden commencements show no evidence of recurrence at 27-day intervals, whereas those starting gradually show a definite tendency to recur. Study of 328 storms of the latter type show that variation of the recurrence period is certainly not great. The extent of the recurrence is most strongly marked in the decreasing phase of the cycle.

551.510.52 : 621.396.11 **1658**

A Theory on Radar Reflections from the Lower Atmosphere.—Gordon. (*See* 1761.)

551.510.52 : 621.396.11 **1659**

Theory and Practice of Tropospheric Sounding by Radar.—Friend. (*See* 1760.)

551.510.535 **1660**

Comparison of Ionospheric Data from Antipodal Points.—(*J. Franklin Inst.*, Jan. 1949, Vol. 247, No. 1, pp. 64–65.) The two most suitable existing stations for such comparison are Watheroo, Western Australia, and Baton Rouge, Louisiana. A statistical comparison shows that Baton Rouge conditions can be predicted nearly as efficiently from Watheroo data as from Baton Rouge data. Watheroo data can be used to predict Brisbane conditions with similar efficiency; this is probably because the difference in longitude between Watheroo and Brisbane is nearly equal to that between Baton Rouge and the antipodal point of Watheroo.

551.510.535 **1661**

The Ionosphere over Mid-Germany in January 1949.—Dieminger. (*Fernmeldetech. Z.*, Feb. 1949, Vol. 2, No. 2, p. 44.) An account of features of special interest, with graphs of the diurnal variation of the monthly mean values of the critical frequencies and heights of the different layers, as determined at the Institute for Ionosphere Research, Lindau über Northeim. See also 1475 of May.

551.510.535 **1662**

Note on Night-Time Phenomena in the F_2-Region at Brisbane.—G. de V. Gipps, D. I. Gipps & H. R. Venton. (*J. Coun. sci. industr. Res. Aust.*, Aug. 1948, Vol. 21, No. 3, pp. 215–221.) (h',f) records made on the multi-frequency recorder at Indooroopilly reveal departure from normal F_2-layer formation at night. Possible ionospheric configurations for producing these abnormalities are discussed.

551.510.535 **1663**

Evidence of Horizontal Motion in Region F_2 Ionization.—W. J. G. Beynon. (*Nature, Lond.*, 4th Dec. 1948, Vol. 162, No. 4127, p. 887.) Irregularities in the F_2 layer near the midpoint of the path, detected by means of signals received at Slough from a transmitter at Zeesen, 990 km east of Slough, were observed 60–75 minutes later overhead. A 70-minute delay would require a horizontal motion of 430 km/hr. See also 1664 below.

551.510.535 **1664**

Short-Period Changes in the F Region of the Ionosphere.—G. H. Munro. (*Nature, Lond.*, 4th Dec. 1948, Vol. 162, No. 4127, pp. 886–887.) An account of observations during the period November 1947–May 1948 to detect horizontal movements in the ionosphere. Signals from a group of three synchronized and suitably phased transmitters were received at one or more of three points, the locations being chosen to provide eight possible combinations for checking uniformity of motion. Clearly defined changes in echoes from the F region showed time differences at the three receiving points indicating a horizontal velocity of 3.9 miles/min in a direction 60°E of N. Time differences also occurred in quasiperiodic variations in the 'split' observed at one receiving point in the echo records for the three transmitters. See also 1663 above.

551.510.535 : 525.624 **1665**

Lunar Variations in the Principal Ionospheric Regions.—D. F. Martyn. (*Nature, Lond.*, 1st Jan. 1949, Vol. 163, No. 4131, pp. 34–36.) Vertical tidal air movements do not account for the semi-diurnal variations in ionosphere characteristics. From consideration of the electrodynamic forces brought into play by horizontal air movements, a semi-diurnal tilting motion about an axis corresponding to the parallel of latitude at about 35° is deduced, with oscillations which are out of phase on opposite sides of the axis. E-layer height measurements confirm this. F-layer variations show no consistent phase difference between high and low latitudes, but this can be explained by the electrical connection between the layers. In the F region tidal air motions may be relatively weak, so that ionospheric variations would be influenced by the stronger low-latitude effects in the E region, with results such as are found. Further support is also provided for the conclusion that the main seat of the lunar magnetic variations is below the E region. See also 1053 of April and back references.

551.510.535 : 621.396.11 **1666**

The Radio Amateur and Upper Atmosphere Research.—O. P. Ferrell. (*CQ*, Feb. 1949, Vol. 5, No. 2, pp. 25–27.. 77.) Discussion of sporadic-E clouds and the part that radio amateurs, operating at frequencies in the 50-Mc/s band, can play in locating them. Observations of marked sporadic-E clouds for two days in 1948 are discussed in detail. See also 3117 of 1948 and 3410 of 1948 (Revirieux : Lejay).

551.551 : 621.396.11 **1667**

The Problem of Diffusion in the Lower Atmosphere.—O. G. Sutton. (*Quart. J. R. met. Soc.*, July/Oct. 1947, Vol. 73, Nos. 317/318, pp. 257–276. Discussion, pp. 276–281.) A detailed discussion, including the conjugate power-law theory of eddy diffusion which was applied by Booker to the problem of superrefraction (1159 of April and back references).

551.553.11 : 621.396.11 **1668**

Sea Breeze Structure with Particular Reference to Temperature and Water Vapour Gradients and Associated Radio Ducts.—R. W. Hatcher & J. S. Sawyer. (*Quart. J. R. met. Soc.*, July/Oct. 1947, Vol. 73, Nos. 317/318, pp. 391–406.) Marked superrefraction occurs when dry air is heated over land and drifts out over cooler sea. The programme of observations here discussed was undertaken because lack of knowledge of sea breeze structure hindered the development of an adequate theory of such superrefraction. Hygrometer readings were taken at vertical intervals of a few hundred feet and horizontal intervals of a few miles near the coast in the Madras district. Results are shown graphically and discussed. The existence of a surface radio duct, as suggested by Booker; is confirmed, but the observations do not indicate any elevated radio duct. See also 1159 of April (Booker) and back references.

551.578.1 : 621.396.9 **1669**

Radar Observation of Heavy Rain.—Whalley & Scoles. (*See* 1675.)

LOCATION AND AIDS TO NAVIGATION

534.88 **1670**

Use of Sonar in Harbor Defense and Amphibious Landing Operations.—E. Klein & T. F. Jones. (*Elect. Engng, N.Y.*, Feb. 1949, Vol. 68, No. 2, pp. 107–114.) Discussion of the development of ultrasonic ranging and d.f. equipment. The 'Herald' equipment comprised a station on the sea bed and a shore station. Remote control of the training and tilting mechanisms for the acoustic mirror was achieved with a step-by-step transmission. A common oscillator for receiver and transmitter, of frequency 175 kc/s above that of the sound beam, greatly simplified operation of the equipment. Ultrasonic beacons for guidance of assault craft transmitted for 12 hours in the band 17–25 kc/s and then automatically flooded and sank.

535.61-15 : 621.383 **1671**

Infra-Red Location [of objects] **with Lead Sulphide Cells.**—Ochmann. (*See* 1732.)

621.396.9 **1672**

1949 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 160–178.) Abstracts are given of the following papers read at the convention:—Symposium on Radio Aids to Navigation, comprising (*a*) The Radio Technical Commission for Aeronautics—its Program and Influence, by J. H. Dellinger, (*b*) Frequency Allocations to the Aeronautical Services above 400 Mc/s, by V. I. Weihe, (*c*) Experimental Multiplexing of Functions in the 960–1 660-Mc/s Frequency Spectrum—its Influence on Weight and Complexity of Equipment, by P. C. Sandretto & R. I. Colin, (*d*) The Philosophy and Equivalence Aspects of Long-Range Radio Navigation Systems, by M. K. Goldstein, and (*e*) The Future in Approach and Landing Systems, by H. Davis. 92. A Forward-Transmission Echo-Ranging System, by D. B. Harris. 115. The Determination of Ground Speed of Aircraft using Pulse-Doppler Radar, by I. Wolff, S. W. Seeley, E. Anderson & W. D. Hershberger. 116. The Dimeal Aircraft Approach and Landing System, by L. B. Hallman, Jr. 117. Theoretical Aspects of Nonsynchronous Multiplex Systems, by W. D. White. 118. Band-Pass Circuit Design for Very-Narrow-Band, Very-Long Range Direction-Finder Receivers to minimize Bearing Error due to Receiver Mistuning, by M. Dishal & H. Morrow. 119. Crystal Control at 1 000 Mc/s for Aerial Navigation, by S. H. Dodington. 130. V.H.F. Airborne Navigational Receiver and Antenna System, by A. G. Kandoian, R. T. Adams & R. C. Davis. 131. Certain New Performance Criteria for Localizer and Glide-Slope Ground Installations, by P. R. Adams. 132. Phase and other Characteristics of 330-Mc/s Glide-Path Systems, by S. Pickles. 133. Principles of Volume Scan [for radar], by D. Levine. 134. The Control of Resonance Effects on the Radio Bearings of an Aircraft High-Frequency Direction Finder, by M. K. Goldstein. Titles of other papers are given in other sections.

621.396.9 **1673**

Principle of Constant Path-Time Difference and its Application in Radiolocation.—W. Stanner. (*Elektron Wiss. Tech.*, Feb. 1949, Vol. 3, No. 2, pp. 70–78.) Discussion of systems using (*a*) elliptical, (*b*) hyperbolic isodromes.

621.396.9 **1674**

Position-Finding by Radio: First Thoughts on the Classification of Systems.—C. E. Strong. (*J. Instn elect. Engrs*, Part I, Jan. 1948, Vol. 95, No. 85, pp. 31–35; reprinted in *Elect. Commun.*, Sept. 1948, Vol. 25, No. 3, pp. 278–285.) Full paper; long summary noted in 1039 of 1948.

621.396.9 : 551.578.1 **1675**

Radar Observation of Heavy Rain.—H. Whalley & G. J. Scoles. (*Nature, Lond.*, 5th March 1949, Vol. 163, No. 4140, p. 372.) Photographs of a radar p.p.i. screen showing a belt of heavy rain passing over the Manchester district are reproduced and briefly discussed.

621.396.9 : 551.594.6 **1676**

Location of Thunderstorms by Radio.—(*Nature, Lond.*, 8th Jan. 1949, Vol. 163, No. 4132, p. 75.) Brief discussion of the British Meteorological Office storm-location network. The apparatus used was described by Adcock & Clarke (2779 of 1947). See also 1056 of April (Ockenden).

621.396.932 **1677**

The Application of Radar to the Science and Art of Marine Navigation.—P. G. Satow. (*J. R. Soc. Arts*, 25th Feb. 1949, Vol. 97, No. 4789, pp. 221–234.) General discussion of the way in which marine radar, developed primarily for war purposes, has been adapted to assist navigation in harbours and narrow waters, collision prevention, position fixing, etc.

621.396.932 **1678**

The Decca Navigator System with Lane Identification.—(*Engineer, Lond.*, 28th Jan. 1949, Vol. 187, No. 4853, pp. 101–102.) The English and Danish chains cover an area of 500 000 square miles; other chains in Scotland and Western England are under construction. Lane identification enables navigators entering the area of coverage to determine a reference point. For this purpose special transmissions take place at approximately one-minute intervals. The identification meter is then illuminated by the appropriate colour (red, green or purple), and the pointer takes up a position from which the corresponding decometer can be set. A vernier arrangement gives greater accuracy of setting, particularly at night.

621.396.933 **1679**

Developing an Indicator for H_2S Equipment.—R. T. Croft. (*J. Brit. Instn Radio Engrs*, Feb. 1949, Vol. 9, No. 2, pp. 75–81.) Description of a rotating radial timebase for a p.p.i., with particular attention to the design of deflection circuits for complete and sector display. The basic circuits for the deflection amplifiers, the c.r. tube supplies and the video amplifiers are also considered.

629.13.014.57 : 621-526 **1680**

Automatic Pilots.—J. C. Owen. (*Elect. Engng, N.Y.*, June 1948, Vol. 67, No. 6, pp. 551–561.) Discussion of the application of servomechanisms to aeroplane control.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.5 + 621.315.59 + 621.315.61 **1681**

1949 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 160–178.) Abstracts are given of the following papers read at the convention:—Symposium on Germanium and Silicon Semiconductors, comprising (*a*) Electrical Properties of Germanium and Silicon, by K. Lark-Horovitz, (*b*) The Metallurgy of Germanium and Silicon Semiconductors, by J. H. Scaff, (*c*) Theory of Rectification, by F. Seitz, and (*d*) Physics of the Transistor, by W. H. Brattain. 56. Conductive Plastic Materials, by M. A. Coler ; F. R. Barnet, A. Lightbody & H. A. Perry. 79. A Critical Survey of Methods of making Ceramic-to-Metal Seals and their Use for Electron-Tube Construction, by R. P. Wellinger. 81. An Improved Method of testing for Residual Gas in Electron Tubes and Vacuum Systems, by E. W. Herold. Titles of other papers are given in other sections.

535.37 **1682**

Theory of the Extinction of Luminescence of Organic Phosphors.—B. Ya. Sveshnikov. (*Zh. eksp. teor. Fiz.*, Oct. 1948, Vol. 18, No. 10, pp. 878–885. In Russian.)

535.37 **1683**

Dependence of the Intensity of the Luminescence of ZnO and ZnS-Zn on the Intensity of Excitation.—F. I. Vergunas & F. F. Gavrilov. (*Zh. eksp. teor. Fiz.*, Oct. 1948, Vol. 18, No. 10, pp. 873–877. In Russian.)

535.37 **1684**

Contributions to the Study of the Photoluminescence of Zinc Sulphide.—J. Saddy. (*Ann. Phys., Paris*, July/Aug. 1947, Vol. 2, pp. 414–455.) The suppressing or enhancing effect of traces of metals of the Fe group on the photoluminescence of Cu-activated ZnS is studied and the principal formulae proposed for the natural decay of the phosphorescence of ZnS-Cu are discussed theoretically and compared with experimental results.

537.228.1 : 549.514.51 **1685**

Calculation of the Piezo-Electric Constants of α-Quartz on Born's Theory.—B. D. Saxena & K. G. Srivastava. (*Indian J. Phys.*, Nov. 1948, Vol. 22, No. 11, pp. 475–482.)

538.23 : 621.318.323.2 **1686**

Hysteresis and Eddy Currents in Coil-Core Stampings in Weak A.C. Fields.—R. Feldtkeller. (*Fernmeldetech. Z.*, Jan. 1949, Vol. 2, No. 1, pp. 9–14.) Measurement results are presented graphically for various Si/Fe and Ni/Fe alloys of German manufacture.

546.287 : 621.315.61 **1687**

Silicones. Their Use in Electrical Technique.—G. de Senarclens. *Bull. schweiz. elektrotech. Ver.*, 9th March 1946, Vol. 37 No. 5, pp. 117–126. In French.) A general account of the preparation and properties of silicone liquids, greases, resins and varnishes, and their use for insulation or lubrication, particularly at relatively high temperatures.

546.289 : 621.315.591.1† : 537.311.33 **1688**

Interpretation of Dependence of Resistivity of Germanium on Electric Field.—E. J. Ryder & W. Shockley. (*Phys. Rev.*, 15th Jan. 1949, Vol. 75, No. 2, p. 310.)

546.431.82 : 621.315.612 **1689**

Production and Investigation of $BaTiO_3$ Single Crystals.—H. Blattner, W. Känzig & W. Merz. (*Helv. phys. Acta*, 15th Feb. 1949, Vol. 22, No. 1, pp. 35–65. In German.) The investigations were concerned with the behaviour of the dielectric constant, the specific heat and the resonance frequency as functions of temperature. Results are shown graphically and discussed.

621.315.553 **1690**

On the Use of New Resistance Materials for Standard Resistors.—A. Schulze. (*Elektrotechnik, Berlin*, Jan. 1949, Vol. 3, No. 1, pp. 23–28.) A detailed account of measurements, extending over a period of about 10 years, of the values of various resistors of the Cu/Mn group of materials, including manganin, novoconstant (82.5% Cu, 12% Mn, 1.5% Fe, 4% Al) and a Heusler alloy 306, and also of Au-Cr and Ag-Mn resistors. The alloy 306 contains some Zn and has a temperature coefficient of resistance of less than 1 part in 10^6 per 1° C. The coefficients of the Au-Cr and Ag-Mn resistors are of the same order. Curves and tables show the variations of the different resistors with time.

621.315.61 : 621.396.662.029.64 **1691**

Attenuator Materials for Microwaves.—G. K. Teal, M. D. Rigterink & C. J. Frosch. (*Elect. Engng, N.Y.*, Aug. 1948, Vol. 67, No. 8, pp. 754–757.) Homogeneous dielectrics have serious drawbacks as attenuator materials. The dielectric properties of inhomogeneous solid lossy dielectrics such as silicon carbide dispersed in porcelain, or graphite dispersed in phenol formaldehyde, are considered ; methods of reducing unwanted reflections at the air/solid interface are discussed. Resistor strips such as sprayed films of graphite pigmented acryloid or silicone can also be used.

621.315.612.011.5 **1692**

Electrical Properties of Ceramics.—E. W. Lindsay & L. J. Berberich. (*Elect. Engng, N.Y.*, May 1948, Vol. 67, No. 5, p. 440.) Long summary of A.I.E.E. paper. If the logarithm of the resistivity, dielectric strength, or power factor be plotted against the reciprocal of the absolute temperature, the graph consists of two straight lines whose intersection determines a transition temperature. Below this temperature, current flow appears to be dominated by dielectric absorption; above, by electrolytic conduction.

621.315.614 **1693**

Thermal Ageing Properties of Cellulose Insulation Materials.—G. Malmlöw. (*Kungl. tekn. Högsk. Handl., Stockholm*, 1948, No. 19, 67 pp. In English.) A general discussion with historical introduction and bibliography of 56 references.

621.315.615.011.5 **1694**

Dielectric Strength of Liquids for Short Pulses of Voltage.—K. A. Macfadyen & W. D. Edwards. (*Nature, Lond.*, 29th Jan. 1949, Vol. 163, No. 4135, pp. 171–172.) Measurements on ethyl alcohol and benzene indicate an increase in their dielectric strength as the pulse duration is reduced. The breakdown, once started, becomes complete in about 10^{-9} sec.

621.315.616.011.5 **1695**

The Electric Strength of some Synthetic Polymers.—W. G. Oakes. (*Proc. Instn elect. Engrs*, Part I, Jan. 1949, Vol. 96, No. 97, pp. 37–43. Discussion, p. 43.) Results for the temperature range − 200° to + 110° C are discussed in the light of Fröhlich's electronic theory of breakdown (2405 of 1947 and back references).

621.315.616.015.5 **1696**

A Note on Crystallite Size and Intrinsic Electric Strength of Polythene.—D. W. Bird & H. Pelzer. (*Proc. Instn elect. Engrs*, Part I, Jan. 1949, Vol. 96, No. 97, pp. 44–45.) Continuation of 764 of 1947 (Austen & Pelzer). No significant difference is found between measurements on quenched and unquenched polythene. Crystallite size therefore appears to have little effect on electric strength.

621.316.99 **1697**

The Behaviour of Earth Connections Subjected to High Current Surges.—K. Berger. (*Bull. schweiz. elektrotech. Ver.*, 20th April 1946, Vol. 37, No. 8, pp. 197–211. In German, with French summary.) The results of measurements with various types of earth connection, subjected to surges from 200 kV to 800 kV with currents ranging up to 11 000 A, are shown graphically and tabulated.

621.318.22 **1698**

The Permanent Magnet Steel "Ticonal" and its Application in Loudspeakers.—(*Philips tech. Commun., Aust.*, April 1948, No. 3, pp. 3–14.)

666.11 : 621.315.612.011.5 : 621.385 **1699**

Contributions to the Study of the Electrical Properties of Glasses used in the Construction of Radio Valves.—P. Meunier. (*Ann. Radioélect.*, Jan. 1949, Vol. 4, No. 15, pp. 54–67.) Methods are described for investigating the variations of resistivity, loss factor, dielectric constant and power dissipation with temperature and frequency. The results obtained have immediate practical application in valve manufacture.

621.315.59 + 621.314.6 + 621.396.622 + 621.383 **1700**

German Research on Semi-Conductors, Metal Rectifiers, Detectors and Photocells. [Book Notice]—B.I.O.S. Final Report No. 1751. H.M. Stationery Office, London, 46 pp., 5s. 6d.

MATHEMATICS

517.512.2 **1701**

A Clear Representation of the Spectral Distribution of Periodic and Nonperiodic Phenomena.—F. A. Fischer. (*Fernmeldetech. Z.*, Jan. 1949, Vol. 2, No. 1, pp. 21–23.) A direct derivation of the Fourier integral for nonperiodic phenomena; for the periodic case the integral transforms into Fourier series.

517.65(083.5) : 621.396.67 **1702**

Iterated Sine and Cosine Integrals.—E. Hallén. (*Kungl. tekn. Högsk. Handl., Stockholm*, 1947, No. 12, 6 pp. In English.) The following functions relevant to aerial theory are tabulated :—

$$L_{11}(x) = C_{11}(x) + iS_{11}(x) = \int_0^x \frac{L(\xi)}{\xi}\, d\xi$$

$$L_{21}(x) = C_{21}(x) + iS_{21}(x) = \int_0^x \frac{e^{i\xi}}{\xi}[L(2\xi) - L(\xi)]\, d\xi$$

where $L(x) = \int^x \frac{(1 - e^{-i\xi})}{\xi}\, d\xi$.

518.5 **1703**

1949 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 160–178.) Abstracts are given of the following papers read at the convention :— Symposium on Electronic Computing Machines, comprising (*a*) Results of Tests on the Binac, by J. W. Mauchly, (*b*) The Mark III Computer, by H. H. Aiken, (*c*) The IBM Type 604 Electronic Calculator, by R. Palmer, (*d*) Electrostatic Memory for a Binary Computer, by F. C. Williams, (*e*) Counting Computers, by G. R. Stibitz, and (*f*) Programming a Computer for Playing Chess, by C. E. Shannon. 37. A Dynamically Regenerated Memory Tube, by J. P. Eckert, Jr, H. Lukoff & G. Smoliar. 38. An Electronic Differential Analyzer, by A. B. Macnee. 39. An Analogue Computer for the Solution of Linear Simultaneous Equations, by R. M. Walker. 40. The Electronic Isograph for a Rapid Analogue Solution of Algebraic Equations, by B. O. Marshall, Jr. 41. A Parametric Electronic Computer, by C. J. Hirsch. Titles of other papers are given in other sections.

518.5 **1704**

Electronic Analog Computer.—H. R. Hegbar. (*Electronics*, March 1949, Vol. 22, No. 3, pp. 168..174.) Results are accurate within 0.1%. Sets of simultaneous differential equations with constant coefficients can be solved.

518.5 : 512.39 **1705**

An Electronic Method for Solving Simultaneous Equations.—A. C. Hardy & E. C. Dench. (*J. opt. Soc. Amer.*, April 1948, Vol. 38, No. 4, pp. 308–312.) For solving equations in 3 or 4 variables arising in colour printing. Each individual variable is involved linearly but the total degree equals the number of variables. Solutions are obtained at the rate of about 1 000 per sec.

518.5 : 517.944 **1706**

Electric Circuit Models of Partial Differential Equations.—G. Kron. (*Elect. Engng, N.Y.*, July 1948, Vol. 67, No. 7, pp. 672–684.) Discussion of electrical models developed to represent some of the basic linear partial differential equations of mathematical physics. The models can be used for all orthogonal curvilinear coordinate systems and can represent transient, sinusoidal, or static fields. Particular equations thus represented include: (*a*) Laplace's and Poisson's equations, (*b*) the general scalar-potential and vector-potential equations, (*c*) compressible fluid flow equations, (*d*) Maxwell's equations, (*e*) the wave equations of Schrödinger, and (*f*) the basic equations of elasticity. The models can be used to solve initial-value, boundary-value and characteristic-value problems. Accuracy is within 1–5%.

518.5 : 517.947.4 **1707**

An Electrical Potential Analyser.—S. C. Redshaw. (*Proc. Instn mech. Engrs, Lond.*, 1948, Vol. 159, War Emergency Issue No. 38, pp. 55–62. Discussion, pp. 62–80.) The analyser provides, in effect, an electrical analogy to the solution of Poisson's and Laplace's equations when expressed in finite difference form. It consists essentially of a square mesh, the nodal points of which are interconnected by low-value wire resistances, and a base. Corresponding points on the mesh and base are connected through high-value resistances. A mesh separation of 1/12 of the side length is satisfactory.

517.564.3(083.5) **1708**

Tables of the Bessel Functions of the First Kind. [Book Review]—Harvard University Press, Cambridge, Mass.; Oxford University Press, London, 1948, 55s. each volume. (*Nature, Lond.*, 29th Jan. 1949, Vol. 163, No. 4135, p. 152.) Vols. 7–10 of the tables compiled by the staff of the Computation Laboratory, Harvard, covering orders 10–39. For orders above 15, a uniform interval of 0.01 is used for the argument. Vols. 3–6 were noted in 463 and 1396 of 1948.

518.2 **1709**

Five-Figure Tables of Natural Trigonometrical Functions. [Book Review]—H.M. Nautical Almanac Office. H.M. Stationery Office, London, 1947, 124 pp., 15s. (*Nature, Lond.*, 5th March 1949, Vol. 163, No. 4140, p. 347.) An auxiliary table gives values of the cotangent for every second of arc up to 7° 30′. The main table gives values of the sine, tangent, cotangent and cosine at 10-second intervals.

MEASUREMENTS AND TEST GEAR

531.76 : 681.11 **1710**

A Watch Rate Recorder.—H. G. M. Spratt. (*Electronic Engng*, Feb. 1949, Vol. 21, No. 252, pp. 39–44.) The amplified ticks of the watch under test actuate a printing bar and are recorded on a paper chart, which is driven at a constant known rate by a power source whose frequency is derived from a quartz oscillator. Circuit diagrams are given, together with detailed examples of the use of the instrument. See also 1669 of 1948 (Mackay & Soule) and 2838 of 1948 (van Suchtelen).

531.761 **1711**

Time Service Equipment at the Dominion Observatory.—G. A. Eiby. (*N.Z. J. Sci. Tech.*, May 1948, Vol. 29, No. 6, pp. 296–308.) The electrical wiring and relay system for this service is described, with photographs and circuit diagrams of certain parts of the equipment. The development, present capabilities and possible extension of the service are considered.

621.3.018.4(083.74) **1712**

Microwave Frequency Standards.—B. F. Husten & H. Lyons. (*Elect. Engng, N.Y.*, May 1948, Vol. 67, No. 5, pp. 436–439.) Long summary of A.I.E.E. paper. Discussion of a new National Bureau of Standards service providing frequency measurements and calibrations of frequency meters or voltage sources. The standard frequencies are derived from a primary 100-kc/s standard, accurate to 1 part in 10^8, by frequency multiplication, conversion, and harmonic selection.

621.317 **1713**

1949 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 160–178.) Abstracts are given of the following papers read at the convention:— 12. Measuring the Efficiency of a Superheterodyne Converter by the Input-Impedance Circle Diagram, by H. A. Wheeler & D. Dettinger. 13. Electrolytic-Tank Measurements for Microwave Delay-Lens Media, by S. B. Cohn. 14. A Michelson-Type Interferometer for Microwave Measurements, by B. A. Lengyel. 15. Impedance Instrumentation for Microwave Transmission Lines, by P. A. Portmann. 16. A Broad-Band High-Power Microwave Attenuator, by H. J. Carlin. 17. An Absolute Method for Measuring Microwave Power of Low Intensity, by H. Herman. 21. The Measurement of Nonlinear Distortion, by A. P. G. Peterson. 32. An Impulse Generator-Electronic Switch for Visual Testing of Wide-Band Networks, by T. R. Finch. 33. A 50-Mc/s Wide-Band Oscilloscope, by A. M. Levine & M. Hoberman. 34. A Timing-Marker Generator of High Precision, by R. C. Palmer. 35. The Evaluation of Specifications for Cathode-Ray Oscillographs, by P. S. Christaldi. 51. Spectrum Analysis of Transient-Response Curves, by H. A. Samulon. 73. An A.M. Broadcast Station Monitor, by H. R. Summerhayes, Jr. 99. High-Impedance Millivolt Measurements above 5 Mc/s, by W. K. Volkers. 101. A Wide-Band Audio Phasemeter, by J. R. Ragazzini & L. A. Zadeh. 102. A Device for Admittance Measurements in the 50–500-Mc/s Range, by W. R. Thurston. 103. An Improved R.F. Capacitometer, by E. F. Travis & T. M. Wilson. Titles of other papers are given in other sections.

621.317.324† : 621.396.615.141.2 **1714**

Rotating Probe Machine.—G. L. Stambach. (*Electronics*, March 1949, Vol. 22, No. 3, pp. 182 . . 189.) For investigating field patterns inside multi-cavity magnetrons. Brief details are given of construction and operation; measured and theoretical results are compared.

621.317.33(083.74) **1715**

Radio Standards.—L. Hartshorn & L. Essen. (*Proc. Instn elect. Engrs*, Part III, Jan. 1949, Vol. 96, No. 39, pp. 37–39.) The status and accuracy of the standards of capacitance, inductance and frequency are briefly reviewed.

621.317.331 : 621.316.99 **1716**

The Measurement of Earth Resistance.—H. Engel. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Feb. 1949, Vol. 27, No. 1, pp. 14–20. In French and German.) An account of simple d.c. methods and also of a new method with particular advantages which uses the a.c. mains supply.

621.317.335.3† : 621.315.611 **1717**

Dielectric Measurement Methods for Solids at Microwave Frequencies.—W. H. Surber, Jr, & G. E. Crouch, Jr. (*J. appl. Phys.*, Dec. 1948, Vol. 19, No. 12, pp. 1130–1139.) A high-loss dielectric sample is enclosed within a section of waveguide; the loss is then calculated from the s.w.r. obtained with open-circuit and with short-circuit termination of the waveguide. Using the same apparatus, the loss of low-loss dielectrics can be measured by matching-in the sample and using a frequency-variation method.

621.317.336 **1718**

Impedance Measurements in Decimetre Wave Band.—B. Josephson. (*Kungl. tekn. Högsk. Handl.*, Stockholm, 1948, No. 23, 70 pp. In English.) For relatively low impedances, a standing-wave method is described in which the distance between the probe and the inner conductor is varied so as to keep the line voltage constant. For high impedances a resonant-circuit method analogous in principle to a Q meter is considered. A comprehensive practical and theoretical study of the two methods includes detailed discussion of apparatus and results.

621.317.336 : 621.396.611.4 **1719**

On the Measurement of Cavity Impedance.—W. W. Hansen & R. F. Post. (*J. appl. Phys.*, Nov. 1948, Vol. 19, No. 11, pp. 1059–1061.) The ratio R/Q is defined, where R is the shunt resistance. R/Q is measured by observing the change in resonant wavelength caused by introducing small conducting buttons into the cavity.

621.317.44 **1720**

An Arrangement for Maintaining a Constant Magnetic Field.—H. Naumann. (*Z. angew. Phys.*, Jan. 1949, Vol. 1, No. 6, pp. 260–264.) Apparatus using large Helmholtz coils for producing fields of the order of that of the earth is compensated for external disturbing effects, both as regards intensity and direction, by means of a variometer. This variometer is operated by photocells whose currents are controlled by the motion of small magnetic needles suitably oriented at points on the axis of the system.

621.317.444† **1721**

A Simple Direct-Reading Fluxmeter.—J. H. Briggs & W. H. Mitchell. (*J. sci. Instrum.*, Feb. 1949, Vol. 26, No. 2, pp. 40–42.) Eccentric cylindrical vanes of aluminium are thinly coated with dust iron having negligible hysteresis. The large torque in a field of the order of 1 000 gauss enables strong control springs and ball-ended pivots to be used for robust instruments that can measure fluxes up to 7 500 gauss, for magnets of various shapes, to an accuracy within 2%.

621.317.7 + 621.396.69 **1722**

Standardised Super-High-Frequency Components and Instruments.—(*See* 1633.)

621.317.73 **1723**

An Automatic Impedance Meter.—H. Werthén & B. Nilsson. (*Kungl. tekn. Högsk. Handl., Stockholm*, 1947, No. 8, 95 pp. In English.) The meter includes a signal generator and alternative recording instruments for rough and accurate measurements respectively. Attenuation and phase can be determined for 2-terminal and 4-terminal networks, at frequencies from 10 kc/s to 500 kc/s.

621.317.73 : 621.315.2.029.6 **1724**

A Pulse Test Set for the Measurement of Small Impedance Irregularities in High-Frequency Cables.—F. F. Roberts. (*Proc. Instn elect. Engrs*, Part III, Jan. 1949, Vol. 96, No. 39, pp. 17–23.) The impedance irregularities are measured in terms of the return loss (up to 90 db) of echo pulses reflected from the irregularities when 0.3-μs 20-Mc/s pulses are fed into the coaxial cable.

621.317.761 **1725**

Some Problems in the Accurate Measurement of Frequencies in the Region of Microwaves (1 500–40 000 Mc/s).—M. Denis & B. Epstein. (*Ann. Radioélect.*, Jan. 1949, Vol. 4, No. 15, pp. 12–25.) Standard-frequency generators of the type developed at the National Bureau of Standards are described and the possibility is considered of using klystron frequency multipliers, associated if need be with travelling-wave valve amplifiers, in lieu of some of the crystal multipliers normally used at u.h.f. Methods of calibrating cavity-type frequency meters are described and block diagrams are given. A suitable klystron frequency multiplier is the X.M.10; this has an input cavity whose resonance frequency is adjustable from 250 to 310 Mc/s, and an output cavity giving any harmonic of the input from the 8th to the 13th. A frequency band from 2 000 to 4 000 Mc/s can thus be covered with a useful power of about 250 mW, the h.f. input power being about 5 W. Crystal multipliers can then extend the range to frequencies of the order of 40 000 Mc/s.

621.317.772 **1726**

An Electronic Phasemeter.—E. F. Florman & A. Tait. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 207–210.) An instrument designed to read within 0.5° and record directly on calibrated scales the phase angle between two sinusoidal voltages for a voltage range of 1–30 V and frequency range 100–5 000 c/s. The voltages are converted to square waves through cascade amplifiers and limiters and applied to two separate phase indicators. One of these has an 180° ambiguity and records the average of the algebraic sum of the square waves. The second indicator is unambiguous; the square waves are differentiated and the proper resultant pulses are used to fire an Eccles-Jordan trigger circuit. The average trigger-valve anode current is proportional to the phase angle between the input voltages.

621.317.784 **1727**

Absolute Power Measurement at Microwave Frequencies.—A. L. Cullen. (*Nature, Lond.*, 12th March 1949, Vol. 163, No. 4141, p. 403.) The technique is similar to that used for measuring light-radiation pressure with a torsion balance. See also 1727.

621.317.784 : 621.314.2.029.3 **1728**

Audio Frequency Transformer Design.—Brockelsby. (*See* 1607.)

621.317.79 : 621.392.26† **1729**

The Reflectometer.—H. R. Allan & C. D. Curling. (*Proc. Instn elect. Engrs*, Part III, Jan. 1949, Vol. 96, No. 39, pp. 25–30.) General theory is given and a design suitable for waveguides using 10-cm waves is described. Applications to the monitoring of standing waves and transmitted power in a radar transmitter system and to the testing of radar receiver sensitivities are considered; reflectometer methods are shown to be superior to other methods. See also 3968 of 1947 (Parzen & Yalow).

621.396.662(083.74) **1730**

Microwave Attenuation Standard.—R. E. Grantham & J. J. Freeman. (*Elect. Engng, N.Y.*, June 1948, Vol. 67, No. 6, pp. 535–537.) Long summary of A.I.E.E. paper. A standard has been established using the heterodyne or i.f. substitution method of calibration. A preliminary model of the standard has been built and its accuracy is within 0.02 db and 0.02% of measured attenuation in the 0–10 db and 10–50-db ranges respectively. Methods of eliminating unwanted modes are discussed.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

534.321.9.001.8 : 539.32 **1731**

Determination of the Elastic Constants of Solids by Ultrasonic Methods.—W. C. Schneider & C. J. Burton. (*J. appl. Phys.*, Jan. 1949, Vol. 20, No. 1, pp. 48–58.)

535.61-15 : 621.383 **1732**

Infra-Red Location [of objects] **with Lead Sulphide Cells.**—W. Ochmann. (*Elektron Wiss. Tech.*, March 1949, Vol. 3, No. 3, pp. 96–101.) A description of German equipment for the location of aircraft, ships etc. A parabolic mirror 150 cm in diameter, with a special reflector system, concentrates the received radiation on the sensitive cell. A device using a rotating glow-lamp provides a visual indication of direction adjustment, a sector of light of increasing extent being seen as the mirror axis approaches the target, with a complete ring of light when on target. Under good conditions the range for aircraft is of the order of 20 km and the accuracy of location within $\frac{1}{10}$ degree.

Optical apparatus, developed at a later date, used lenses 8 cm in diameter made from a special material, principally lithium fluoride, with very good infra-red transmission properties. With this apparatus a bomber could be located at a distance of 3 km.

539.16.08 + 621.3 **1733**

1949 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 160–178.) Abstracts are given of the following papers read at the convention:—57. The R.F. System for the University of Rochester 130-inch Synchrocyclotron, by W. W. Salisbury. 59. Design of a G-M Counter Tube for High Counting Rates, by W. W. Managan. 61. Proportional-Counter Equipment for Beta Detection, by W. Bernstein. 62. Industrial Thickness Gauges employing Radioisotopes, by J. R. Carlin. 77. Radar-Circuit-Powered X-Ray Movie Equipment for Operation at 150 Frames per Second, by D. C. Dickson, Jr, C. T. Zavales & L. F. Ehrke. 104. A Radio-Frequency Gas-Discharge Phenomenon and its Application to Mechanical Measurements, by K. S. Lion & J. W. Sheetz. Titles of other papers are given in other sections.

550.838 : 538.71 **1734**

Canadian Aerial Magnetic Surveys (M.A.D.).—R. Bailey. (*Canad. J. Res.*, Dec. 1948, Vol. 26, Sec. F, No. 12, pp. 523–539.) Tests with an airborne magnetic detector measuring the earth's total field indicate that it has a high degree of accuracy and speed for reconnaissance work over large areas and is cheap to operate.

551.508.1 : 621.396.9 **1735**

The Development of the Meteorological Office Radar Reflector, Mk. IIB.—O. M. Ashford & H. J. Ferrer. (*Met. Mag.*, Oct. 1948, Vol. 77, No. 916, pp. 224–227.) The development and performance of a corner reflector, with planes of nylon mesh impregnated with silver, for use with 10-cm radar in the detection of upper winds. The reflector performs slightly better than a standard 3-ft paper reflector; it has less drag and requires less storage space.

621.317.39 **1736**

Electronic Gauges.—J. Schwartz. (*Microtecnic, Lausanne*, Oct. & Dec. 1948, Vol. 2, Nos. 5 & 6, pp. 199–206 & 267–274. In English.) Discussion of various devices for transforming mechanical quantities into electrical voltages, including (*a*) piezoelectric gauging heads for measuring large pressures or forces, (*b*) strain gauges of the resistance type, (*c*) gauges using variation of capacitance, magnetic flux or inductance, (*d*) arrangements which transform dimension changes into variations of the illumination of photocells. The relative merits of these various types for precision measurements are considered; methods using variations of capacitance or inductance are particularly suitable for precision measurements of length.

621.317.39 : 620.178.3 **1737**

Vibration Testing of Airplanes.—A. R. Willson. (*Electronics*, March 1949, Vol. 22, No. 3, pp. 86–91.) Fatigue and vibration test methods are described and the layout of equipment for a typical aircraft test is illustrated. Below 7 c/s, motor-triggered thyratrons operate the e.m. source of vibration, while electronic equipment is used for higher frequencies. Measuring and recording techniques are described and the type of oscillograph record obtained is shown. See also 3217 of 1947 (Cogman) and 3218 of 1947 (Corke).

621.365.5 + 621.365.92 **1738**

Radio-Frequency Heating.—L. Hartshorn. (*Not. Proc. roy. Instn*, 1948, Vol. 33, No. 153, pp. 541–553.) Discussion of the underlying principles of induction and dielectric heating, with illustrative examples.

621.38.001.8 **1739**

Design for a Brain.—W. Grey Walter: W. Summer: H. F. Sheppard: A. Greenwood-Wilson: P. T. Hobson: W. R. Ashby. (*Electronic Engng*, Feb. 1949, Vol. 21, No. 252, pp. 62–63.) Discussion on 1144 of April.

621.38.001.8 : 061.3 **1740**

Applications of Electronics to Research and Industry.—(*Nature, Lond.*, 19th Feb. 1949, Vol. 163, No. 4138, pp. 294–297.) For another account see 1145 of April.

621.38.001.8 : 578.088.7 **1741**

Electronic Mapping of the Activity of the Heart and the Brain.—S. Goldman, W. E. Vivian, Chi Kuang Chien & H. N. Bowes. (*Science*, 24th Dec. 1948, Vol. 108, No. 2817, pp. 720–723.) Any point P of the surface of the chest or skull corresponds to a point P′ on the face of a c.r. tube. The brightness at P′ is proportional to the potential at P.

621.38.001.8 : 615.84 **1742**

The Electromedical Significance of Decimetre and Centimetre Waves.—W. Reusse. (*Elektrotechnik, Berlin*, Jan. 1949, Vol. 3, No. 1, pp. 3–10.) Review of capacitor, inductor and radiation methods of applying h.f. energy in medicine, with discussion of the absorption of dm and cm waves by various organic substances, and of selective effects and methods of treatment.

621.384.611.1† **1743**

16-MeV Betatron at the Clarendon Laboratory, Oxford.—(*Engineering, Lond.*, 21st Jan. 1949, Vol. 167, No. 4330, pp. 55–58.) For an earlier account see 3482 of 1948 (Wilkinson, Tuck & Rettie).

621.384.62† **1744**

A Proposed New Form of Dielectric-Loaded Wave-Guide for Linear Electron Accelerators.—R. B. R. S. Harvie. (*Nature, Lond.*, 4th Dec. 1948, Vol. 162, No. 4127, p. 890.) A cylindrical metal waveguide has dielectric loading in the form of circular washers, whose thickness and spacing are small compared with the wavelength in the guide. The washers have a smaller dielectric constant in the direction of the waveguide axis than in the transverse directions. This anisotropy reduces power losses. The total losses compare favourably with those for a corrugated waveguide. A numerical example is discussed.

621.385.833 **1745**

The Theoretical Resolution Limit of the Electron Microscope.—O. Scherzer. (*J. appl. Phys.*, Jan. 1949, Vol. 20, No. 1, pp. 20–29.) The resolving power of the electron microscope and the contrast in the image are calculated for different conditions of focusing, illumination and aperture.

621.385.833 **1746**

The Optical Properties of Electrostatic Lenses, and the Proton Microscope.—P. Chanson. (*Ann. Phys., Paris*, July/Aug. 1947, Vol. 2, pp. 333–413.) A comprehensive treatment, including discussion of aberration and of the resolving power of the electron microscope. With the proton microscope higher resolution should be possible.

621.385.833 **1747**

A New Horizontal Electron Microscope.—N. N. Das Gupta, M. L. De, D. L. Bhattacharya & A. K. Chaudhury. (*Indian J. Phys.*, Nov. 1948, Vol. 22, No. 11, pp. 497–513.) Technical details of construction, power supplies, and operation of an instrument constructed at the University College of Science, Calcutta. Capable of operating at a maximum electron energy of 80 000 eV, it is designed to give a magnification of 20 000 diameters. The horizontal arrangement enables any part to be easily dismantled or adjusted. A historical outline of research in this field is also given.

621.385.833 **1748**

Electron Microscopy.—C. J. Burton. (*Anal. Chem.*, Jan. 1949, Vol. 21, No. 1, pp. 36–40.) A survey of progress in the last 10 years, with bibliography of 159 references.

621.385.833 : 061.3 **1749**

Electron Microscopy Conference [Cambridge, England, Sept. 1948].—V. E. Cosslett. (*Nature, Lond.*, 1st Jan. 1949, Vol. 163, No. 4131, pp. 32–34.) A general account of the proceedings.

621.385.833 : 621.316.722.1 **1750**

Stabilization of the Accelerating Voltage in an Electron Microscope.—van Dorsten. (*See* 1805.)

621.385.833 : 621.317.729 : [537.291 + 538.691 **1751**

Plotting Electron Trajectories.—K. F. Sander, C. W. Oatley & J. G. Yates. (*Nature, Lond.*, 12th March 1949, Vol. 163, No. 4141, p. 403.) A new method for electron-optical systems. A differential analyser is used to integrate the equations of motion of an electron, the components of acceleration being determined by automatic measurements in an electrolyte tank. Results obtained agree satisfactorily with theory.

621.386.1 : 778.332 : 548.73 **1752**

An Improved X-Ray Diffraction Camera.—W. Parrish & E. Cisney. (*Philips tech. Rev.*, Dec. 1948, Vol. 10, No. 6, pp. 157–167.) Various factors involved in design and interrelated in their influence on the properties of diffraction patterns are considered.

621.38.001.8 **1753**

Industrial Electronics Reference Book. [Book Review] —Westinghouse Electric Corporation. J. Wiley, New York; Chapman & Hall, London, 1948, 680 pp., $7.50. (*Science*, 14th Jan. 1949, Vol. 109, No. 2820, p. 44.) A "digest embracing the applications as well as the design data". Many excellent graphs, tables and illustrations concerning materials and equipment are included; theory is necessarily treated briefly. See also *Electronics*, March 1949, Vol. 22, No. 3, pp. 247, 248.

PROPAGATION OF WAVES

535.421 : 538.56 **1754**

On the Diffraction of Electromagnetic Waves at a Wire Grid.—R. Honerjäger. (*Ann. Phys., Lpz.*, 20th Sept. 1948, Vol. 4, Nos. 1/2, pp. 25–45.) The theory of Wessel (5 of 1940) for plane waves incident normally on an unlimited plane grid of parallel wires applied to wavelengths exceeding half the grid spacing. The theory is here extended to any angle of incidence and any wavelength, and verified by experiments with waves in a rectangular waveguide.

538.566 **1755**

Study of the Wave obtained by Total Vitreous Reflection in Media with Non-Zero Magnetic Susceptance.—H. Arzeliès. (*Ann. Phys., Paris*, Sept./Oct. 1947, Vol. 2, pp. 517–535.) The classical formulae of Fresnel only apply to nonmagnetic media. The corresponding general formulae here derived are symmetrical for the two principal waves and are consequently, in spite of their generality, easier to handle than the particular formulae of Fresnel. Applications to the technique of centimetre and millimetre waves are discussed.

538.566 **1756**

On the Calculation of the Electromagnetic Energy Dissipated in a Medium with Selective Absorption.—H. Arzeliès. (*Ann. Phys., Paris*, Sept./Oct. 1947, Vol. 2, pp. 536–554.)

621.396.11 **1757**

1949 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 160–178.) Abstracts are given of the following papers read at the convention:—42. V.H.F. Television—Propagation Aspects, by E. W. Allen, Jr. 43. Propagation Variations at V.H.F. and U.H.F., by K. Bullington. 44. Propagation Tests at U.H.F., by J. Fisher. 45. A Test of 450-Mc/s Urban-Area Transmission to a Mobile Receiver, by A. J. Aikens & L. Y. Lacy. 46. Echoes in Transmission at 450 Mc/s from Land-to-Car Radio Units, by W. R. Young & L. Y. Lacy. 88. An Analysis of Distortion resulting from Two-Path Propagation, by I. H. Gerks. 91. Propagation Conditions and Transmission Reliability in the Transitional Microwave Range, by T. F. Rogers. Titles of other papers are given in other sections.

621.396.11 **1758**

Ground-Wave Propagation over an Inhomogeneous Smooth Earth.—G. Millington. (*Proc. Instn elect. Engrs*, Part III, Jan. 1949, Vol. 96, No. 39, pp. 53–64.) Assuming the inhomogeneity to consist of annulae of homogeneous earth, concentric with the transmitter, the terminal field strength for short waves is shown to be the geometric mean of the values it would have if the earth were homogeneous and of the type near (*a*) the transmitter and (*b*) the receiver. Energy considerations enable the result to be extended, approximately, for longer waves. A tentative solution at the boundary shows that there is a recovery of field strength before attenuation sets in, when the wave passes to a more highly conducting region. Stress is laid on the need for more experimental verification.

621.396.11 **1759**

Radiation Pressure of Centimetre Waves.—N. Carrara & P. Lombardini. (*Nature, Lond.*, 29th Jan. 1949, Vol. 163, No. 4135, p. 171.) The pressure was measured by the torque produced on a torsion balance in a rarefied atmosphere at a pressure of 10 mm Hg. The balance was placed near the mouth of a rectangular waveguide connected to a magnetron generating 50 W mean power at $\lambda = 3$ cm. The observed pressure was about 10^{-2} dyne/cm². Theoretical considerations suggest a reduction in radiation pressure inside a waveguide. See also 1727.

621.396.11 : 551.510.52 **1760**

Theory and Practice of Tropospheric Sounding by Radar.—A. W. Friend. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 116–138.) 1948 I.R.E. National Convention paper. Soundings have been made (*a*) at m.f. between 1935 and 1942, (*b*) more recently, by means of a modified SCR-584 and AN/CPS-1(MEW) microwave radar, with continuous photographic recording. The types of echo that can be received in each of these cases are discussed, with illustrative examples; they include, at medium frequencies, discrete echoes from air-mass boundaries or thick regions of relatively high dielectric-constant gradient and, with microwaves, scattering from raindrops, snowflakes etc., and dot, line and other unusual weak-echo signals. The origins of many microwave echoes appear from theory and experimental evidence to be in the fine structures of the dielectric transition layers of air-mass boundaries and turbulent regions. Much valuable information could be obtained by the use of 3 vertical beam systems for simultaneous and continuous sounding and recording, operating with high-gain aerials and the maximum power available at frequencies of say 400, 4 000 and 40 000 Mc/s.

621.396.11 : 551.510.52 **1761**

A Theory of Radar Reflections from the Lower Atmosphere.—W. E. Gordon. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1949, Vol. 37, No. 1, pp. 41–43.) 'Angels' may be attributed to sharp changes in the dielectric constant produced by atmospheric turbulence.

621.396.11 : 551.510.535 **1762**

Predicting Maximum Usable Frequency from Long-Distance Scatter.—A. H. Benner. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1949, Vol. 37, No. 1, pp. 44–47.) From observations of long-distance scatter it is concluded that E-layer clouds are responsible for the leading edge of the echo but that the maximum amplitude is returned from the ground. This is used as a basis for calculating the m.u.f. from the time delay of the scatter.

621.396.11 : 551.510.535 **1763**

Deviation at Vertical Incidence in the Ionosphere.—G. Millington. (*Nature, Lond.*, 5th Feb. 1949, Vol. 163, No. 4136, p. 213.) Even at vertical incidence the reflection points of the ordinary and extraordinary rays can be separated by a horizontal distance of some 50 km if the frequency is near the ordinary-ray critical frequency. *P'f* records therefore need careful interpretation if a large horizontal gradient in ionization is likely.

621.396.11 : 551.510.535 **1764**

The Radio Amateur and Upper Atmosphere Research.—Ferrell. (*See* 1666.)

621.396.11 : 551.551 **1765**

The Problem of Diffusion in the Lower Atmosphere.—Sutton. (*See* 1667.)

621.396.11 : 551.553.11 **1766**

Sea Breeze Structure with Particular Reference to Temperature and Water Vapour Gradients and Associated Radio Ducts.—Hatcher & Sawyer. (*See* 1668.)

621.396.812 + 538.566.3 **1767**

Photographic Record and Diagrams of Luxembourg Effect with Resonance (Gyro-Interaction).—M. Cutolo & R. Ferrero. (*Nature, Lond.*, 8th Jan. 1949, Vol. 163, No. 4132, pp. 59–60.) Discussion of the results of observations carried out in May and June 1948 to measure the depths of parasitic modulation obtained when using a disturbing wave whose frequency was equal to the local gyrofrequency. For earlier work see 513 of 1947 (Cutolo, Carlevaro & Ghergi), 2055 of 1948 (Cutolo) and 1477 of May.

RECEPTION

621.316.729 : 621.396.619.16 : 621.396.41 **1768**

Synchronization for the P.C.M. Receiver.—J. M. Manley. (*Bell Lab. Rec.*, Feb. 1949, Vol. 27, No. 2, pp. 62–66.) The incoming pulse frame is automatically and continuously examined every 125 μs. Any errors of alignment are corrected in under 0.1 sec by a switch system.

621.396.621 **1769**

1949 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 160–178.) Abstracts are given of the following papers read at the convention :— 100. Some Aspects of the Performance of Mixer Crystals, by P. D. Strum. 125. Design in Nature [for improved signal/noise ratio] as Exploited by the Communication Engineer, by L. A. de Rosa. 128. Signal-to-Noise Improvement through Integration in a Storage Tube, by J. V. Harrington & T. F. Rogers. 129. Theory of Receiver Noise Figure, by L. J. Cutrona. Titles of other papers are given in other sections.

621.396.621 **1770**

Panoramic Reception.—S. A. W. Jolliffe & J. D. Peat. (*Marconi Rev.*, Jan./March 1949, Vol. 12, No. 92, pp. 27–33.) General design considerations are discussed and a panoramic adaptor for the Type CR.100 communications receiver is described in detail.

621.396.621 **1771**

The Marconi Single Sideband Receiver Type CRD.150/20B-SSR.2.—C. P. Beanland. (*Marconi Rev.*, Jan./March 1949, Vol. 12, No. 92, pp. 21–26.) Advantages of single-sideband working for s.w. radio links are discussed. The receiver is adapted for single-sideband working from a basic receiver unit Type CRD.150/20B which by itself is a triple-diversity commercial telephony receiver.

621.396.621 : 621.396.619.13 **1772**

The Demodulation of a F.M. Carrier and Random Noise by a Limiter and Discriminator.—N. M. Blachman. (*J. appl. Phys.*, Jan. 1949, Vol. 20, No. 1, pp. 38–47.) Analysis based on the statistics of random noise. When the degree of limiting is large, as the input signal/noise ratio s_1 increases from 0 to 6 db, the output signal/noise ratio increases sharply from a value far below s_1 to a value only 0.9 db below. As the limiting action is reduced so the ratio of output/input signal/noise ratio tends to increase to the values obtained with square-law detection of a carrier with 100% a.m.

621.396.621.53 **1773**

On the Mixing Properties of Non-Linear Condensers.—A. van der Ziel. (*J. appl. Phys.*, Nov. 1948, Vol. 19, No. 11, pp. 999–1006.) If the charge and voltage are assumed to be related by the equation

$$Q = \alpha_0 V + \alpha_1 V^2 + \alpha_2 V^3 + \ldots,$$

it is shown that the conversion transconductance is imaginary and the input and output impedances are capacitive. If the mixing oscillator frequency f_m is lower than the signal frequency f_i, the power gain is less than unity; if $f_m > f_i$ oscillations may occur; and if the i.f. is $f_m + f_i$, frequency instability may result. Bandwidth and noise factor are discussed, and a few supporting experiments described. A brief comparison with the work of Pound and Durand (2609 of 1948) on Ge diodes is given.

621.396.622 + 621.315.59 + 621.314.6 + 621.383 **1774**

German Research on Semi-Conductors, Metal Rectifiers, Detectors and Photocells. [Book Notice]—(*See* 1700.)

621.396.622.71 **1775**

A Study of the Operating Characteristics of the Ratio Detector and its Place in Radio History.—E. H. Armstrong. (*Proc. Radio Cl. Amer.*, 1948, Vol. 25, No. 3, pp. 3–20.) An experimental investigation of the f.m. ratio detector, with circuit diagrams and oscillograms. See also 2346 of 1948 (Seeley) and back references.

621.396.822 **1776**

Some Notes on Noise Figures.—H. Goldberg. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1949, Vol. 37, No. 1, p. 40.) Corrections to 505 of February.

621.396.822 : 621.318.572 **1777**

Spurious Signals Caused by Noise in Triggered Circuits.—D. Middleton. (*J. appl. Phys.*, Sept. 1948, Vol. 19, No. 9, pp. 817–830.) The expected number of spurious peaks/sec, caused by noise or by a triggering pulse in the presence of noise, above a given triggering level, is calculated. The effects of bandwidth, pulse shape, filter response-curve shape, and rectification are considered. Significantly improved rejection of spurious peaks by a circuit follows only when the maximum tolerable number of triggering peaks is of the same order of magnitude as the noise bandwidth. Results are summarized in tables and curves.

621.396.822 : 621.396.619.16 **1778**

Noise in a Pulse-Frequency-Modulation System.—F. L. H. M. Stumpers. (*Philips Res. Rep.*, Aug. 1948, Vol. 3, No. 4, pp. 241–254.) The optimum filter for pulse-frequency modulation is derived for any given pulse form and large signal/noise ratio. For some special pulse forms the signal/noise ratio is calculated and normal f.m. is shown to give a better result. A method of calculating the noise spectrum is given; it is valid for all signal/noise ratios but is intricate. The noise threshold is estimated and the suppression of the modulation by noise is considered.

621.396.823 **1779**

Radiation from Car Ignition Systems.—B. G. Pressey & G. E. Ashwell. (*Wireless Engr*, Jan. 1949, Vol. 26, No. 304, pp. 31–36.) Field-strength measurements on a typical car ignition system were made with a set having a bandwidth of 2.5 Mc/s and a c.r. indicator. The general level of the field was maintained throughout the frequency range of 40–650 Mc/s and its value was about

10 mV/m at a distance of 9 m, for either vertical or horizontal polarization. The effect of two resistive suppressor systems was examined; suppression ratios of the order of 20 db were obtained.

621.396.823 : 537.523.3 **1780**

Radio Influence from High-Voltage Corona.—G. R. Slemon. (*Elect. Engng, N.Y.*, Feb. 1949, Vol. 68, No. 2, pp. 139–143.) Experiments were conducted using a single conductor at high voltage mounted parallel to an earthed plane. Experimental verification of Peek's formula for corona threshold voltage was obtained. Noise threshold was independent of frequency, though increase of frequency produced increased noise. Noise from a smooth conductor was produced only during negative peaks of the applied a.c. voltage. Weathering and conductor-contamination usually reduced noise considerably, indicating a possible method of controlling corona interference. Water on the conductor caused severe noise with positive d.c., but eliminated noise with negative d.c. In all cases, the initiation of audible sound and light radiation was coincident with that of radio noise.

621.396.828 **1781**

The Measurement and Suppression of Radio Interference.—J. H. Evans. (*J. Brit. Instn Radio Engrs*, Feb. 1949, Vol. 9, No. 2, pp. 46–59.) A survey of the nature of interference and the principles of its measurement, with particular reference to mains-borne noise and domestic appliances. A comprehensive measuring set and a simpler version for factory use are briefly described. Methods of suppression and the difficulties of application are discussed. The recommended limits of interference are considered and some of the anomalies arising from the specification of such limits are indicated.

621.396.828 **1782**

Heterodyne Eliminator.—J. L. A. McLaughlin. (*Electronics*, March 1949, Vol. 22, No. 3, pp. 83–85.) For high attenuation of interference at frequencies close to that of a c.w. or modulated carrier. There is no loss in transmitted intelligence.

STATIONS AND COMMUNICATION SYSTEMS

621.39 : 665.5 **1783**

Telecommunications in the Petroleum Industry.—Z. Friedberg. (*J. Inst. Petroleum*, May 1948, Vol. 34, No. 293, pp. 309–330.) A general description of systems used by oil companies. The basic principles essential for securing reliable communications under the conditions encountered are outlined.

621.39.001.11 : 621.396.822 **1784**

Communication in the Presence of Noise.—Shannon. (*See* 1649.)

621.396 **1785**

1949 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 160–178.) Abstracts are given of the following papers read at the convention:—1. Development of a High-Speed Communication System, by D. S. Bond. 2. Distortion in a Pulse-Count-Modulation System with Nonuniform Spacing of Levels, by P. F. Panter & W. Dite. 3. Cross-Talk Considerations in Time-Division Multiplex, by S. Moskowitz, L. Diven & L. Feit. 4. Experimental Verification of Various Systems of Multiplex Transmission, by D. R. Crosby. 5. Interference Characteristics of Pulse-Time Modulation, by E. R. Kretzmer. 6. Factors involved in the Design of an Improved Frequency-Shift Receiving System [for naval facsimile], by C. C. Rae. 67. Television by Pulse-Code Modulation, by W. M. Goodall. 110. A Microwave System for Television Relaying, by J. Z. Millar & W. B. Sullinger. 112. Intercity Television Radio Relays, by W. H. Forster. 113. Video Design Considerations in a Television Link, by M. Silver, H. French & L. Staschover. 114. Six-Channel Urban Mobile System with 60-kc/s Spacing, by R. C. Shaw, P. V. Dimock, W. Strack & W. C. Hunter. 117. Theoretical Aspects of Nonsynchronous Multiplex Systems, by W. D. White. 126. Experimental Determination of Correlation Functions and the Application of these Functions in the Statistical Theory of Communications, by T. P. Cheatham, Jr. 127. The Transmission of Information through Band-Limited Transmission Systems, by W. P. Boothroyd & E. M. Creamer, Jr. Titles of other papers are given in other sections.

621.396.61/.62 **1786**

Modifying the T.R.1143 for Amateur Use.—G. L. Benbow. (*R.S.G.B. Bull.*, Oct. 1948, Vol. 24, No. 4, pp. 85–87.) The T.R.1143 covers frequencies from 100 to 125 Mc/s and is obtainable under the Ministry of Supply disposals scheme. Full circuit details for the conversion are given, with practical notes.

621.396.61/.62 : 534.86 : 621.395.623.7 **1787**

Fundamental Electroacoustic Principles for the Transmission of a Wide Band of Audio Frequencies.—W. Furrer, A. Lauber & P. Werner. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Feb. 1949, Vol. 27, No. 1, pp. 3–14. In French and German.) Microphones, amplifiers, transmitter and receiver circuits, and the acoustic properties of studios are today all capable of meeting requirements for an a.f. band extending up to about 15 kc/s. The outstanding problem is that of loudspeakers, which are particularly considered here. Some types of combination coaxial loudspeakers give satisfactory results. For high-fidelity u.s.w. reception, special loudspeakers appear indispensable, even if this does increase the cost considerably.

621.396.619.16 **1788**

Timing Control for P.C.M.—A. E. Johanson. (*Bell Lab. Rec.*, Jan. 1949, Vol. 27, No. 1, pp. 10–15.) A detailed explanation, with block and waveform diagrams.

621.396.619.16 **1789**

The Spectrum of Modulated Pulses.—E. Fitch. (*Proc. Instn elect. Engrs*, Part III, Jan. 1949, Vol. 96, No. 39, p. 24.) Discussion on 2619 of 1948. See also 3752 of 1946 (Gladwin).

621.396.619.16 : 621.396.41 **1790**

Multiplex Employing Pulse-Time and Pulsed-Frequency Modulation.—H. Goldberg & C. C. Bath. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1949, Vol. 37, No. 1, pp. 22–28.) Pulsed time-division transmission channels may be effectively doubled in number by adding f.m. bursts on the pulsed microwave carrier. Experimental studies indicate that crosstalk on either channel may be kept 60 db below maximum output, in the worst case of a single pulse-time channel. Experimental transmitter and receiver circuits and waveforms are described and illustrated.

621.396.619.16 : 621.396.41 : 621.316.729 **1791**

Synchronization for the P.C.M. Receiver.—Manley. (*See* 1768.)

621.396.65 : 621.396.932 **1792**

The Great Lakes Radiotelephone System.—R. H. Herrick. (*Elect. Engng, N.Y.*, Feb. 1949, Vol. 68, No. 2, pp. 152–157.) Description of the ship and shore equipment and services provided. See also 2432 of 1947.

621.396.65.029.64 **1793**

A Broad-Band Microwave Relay System between New York and Boston.—G. N. Thayer, A. A. Roetken, R. W. Friis & A. L. Durkee. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 183–188.) See 2920 of 1948 (Chaffee) and back references.

621.396.712 **1794**

The Skelton Short-Wave Transmitting Station of the British Broadcasting Corporation.—(*Engineering, Lond.*, 7th & 14th Jan. 1949, Vol. 167, Nos. 4328 & 4329, pp. 7–9 & 32–33.) A fuller account than that noted in 3521 of 1948.

621.396.712.3 + 621.397.7 **1795**

Planning Radio and Television Studios.—G. M. Nixon. (*Broadcast News*, Dec. 1948, No. 52, pp. 58–69.) General discussion of requirements of space, shape, noise prevention, control arrangements, etc.

621.396.72 **1796**

Headquarters' Station GB1RS.—(*R.S.G.B. Bull.*, Aug. 1948, Vol. 24, No. 2, pp. 26–27.) A short description of the equipment, which is crystal-controlled on a frequency of 3 500.25 kc/s. This frequency and its harmonics provide a series of points below which an amateur transmitter in the 3.5-, 7-, 14- or 28-Mc/s bands cannot be considered 'safely inside'. Transmissions, lasting a few minutes, are made each hour from 0600 to 2400 G.M.T. (or B.S.T. if in force) in Morse code at 12 words/min.

621.396.931 **1797**

V.H.F. Radio Equipment for Mobile Services.—D. H. Hughes. (*J. Brit. Instn Radio Engrs*, Jan. 1949, Vol. 9, No. 1, pp. 30–44.) The advantages of the frequency band 30–180 Mc/s for local R/T services to vehicles and the planning of such systems are reviewed. The design of suitable transmitters and receivers for the mobile and fixed stations is illustrated by a description of a particular type of equipment. Future trends in development are discussed.

621.396.932 **1798**

Single Sideband Radio-Telephony.—H. D. B. Kirby. (*Wireless World*, March 1949, Vol. 55, No. 3, pp. 90–91.) An outline of single-sideband working is given, together with the block diagram of a 300-W transmitter installed on the liner *Caronia*. Two a.f. signals, together with the output of a 100-kc/s oscillator, are fed to balanced modulators. Crystal filters select the upper sideband from one and the lower sideband from the other. These are mixed with a greatly reduced carrier and applied with the output of a 3-Mc/s oscillator to another balanced modulator. A 3.1-Mc/s filter selects the upper modulation product, which is mixed with a variable frequency (7–19 Mc/s) to give the signal frequency (4–22 Mc/s). See also *Engineer, Lond.*, 4th Feb. 1949, Vol. 187, No. 4854, p. 145.

621.396.932 **1799**

Caronia Radio Equipment.—(*Wireless World*, March 1949, Vol. 55, No. 3, pp. 91–92.) A few details of the various telegraphy, telephony, d.f. and radar sets installed in *S.S. Caronia*.

SUBSIDIARY APPARATUS

621-526 + 621.316.7 + 621.396.68 **1800**

1949 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 160–178.) Abstracts are given of the following papers read at the convention:—36. Photographic Techniques in Cathode-Ray Oscillography, by C. Berkley & H. Mansberg. 60. High-Voltage Supplies for Radiation-Measuring Equipment, by R. Weissman & S. Fox. 72. Improved Degenerative Regulators, by Y. P. Yu. Titles of other papers are given in other sections.

621-526 : 629.13.014.57 **1801**

Automatic Pilots.—Owen. (*See* 1680.)

621.313.12 : 538.652 : 534.232 **1802**

Magnetostriction Generators.—J. A. Osborn. (*Elect. Engng, N.Y.*, June 1948, Vol. 67, No. 6, pp. 571–578.) A survey of fundamental magnetostriction phenomena and their application to the conversion of mechanical to electrical energy, and vice versa.

621.313.3 : 629.135 **1803**

A Rectified A.C. Electric System for Aircraft.—L. M. Cobb, W. L. Kershaw & Q. E. Erlandson. (*Elect. Engng, N.Y.*, Feb. 1949, Vol. 68, No. 2, pp. 95–101.) A system using four 30-V 3-phase engine-driven alternators, each output being rectified by means of a Se rectifier to 28 V d.c. and connected to a common busbar. Two 34-A.hr batteries provide initial field excitation and are permanently connected in parallel with the supply. Each rectifier, with suitable cooling arrangements, can supply 400 A. An estimated overall efficiency of 72% is obtained.

621.316.722 **1804**

Some Characteristics of Glow-Discharge Voltage Regulator Tubes.—E. W. Titterton. (*J. sci. Instrum.*, Feb. 1949, Vol. 26, No. 2, pp. 33–36.) Measurements of samples of different tube types indicate that (*a*) the static characteristics show negative resistance discontinuities, (*b*) hysteresis voltage effects occur under dynamic conditions, and (*c*) characteristics of tubes of the same type differ widely. The input voltage with series resistor is calculated in terms of the load current and the permissible tube current.

621.316.722.1 : 621.385.833 **1805**

Stabilization of the Accelerating Voltage in an Electron Microscope.—A. C. van Dorsten. (*Philips tech. Rev.*, Nov. 1948, Vol. 10, No. 5, pp. 135–140.) Two regulating valves are used in a feedback circuit to keep the voltage constant within 0.02% for at least 30 sec at any level between 50 kV and 150 kV.

621.362 **1806**

Thermoelectric Generator Designs.—G. B. Ellis. (*Elect. Engng, N.Y.*, July 1948, Vol. 67, No. 7, pp. 657–660.) Theoretical and practical aspects of the design of thermocouples as sources of power are discussed and the required magnitude of some of the thermal and electrical characteristics is indicated. No efficient thermocouple has yet been developed; the best approach may be in the field of semiconductors. Characteristics of some materials are given.

621.396.68 **1807**

Some Additions to the Theory of Radio-Frequency High-Voltage Supplies.—G. W. C. Mathers. (*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 199–206.) The double-tuned overcoupled air transformer is represented by an equivalent circuit, which is used to develop the theory of the oscillator, including the two possible operating frequencies, the necessary conditions for oscillation and maximum efficiency, and the variation of operating frequency and load resistance with primary tuning. At the operating frequency, the load impedance is purely resistive. The various resistances in the circuit representing the power losses and the load resistance are included in the equivalent circuit resistance, which appears as the anode load of the class-C oscillator valve. Methods of designing a circuit to give any required power and voltage output are discussed.

621.396.68 : 621.397.62 : 535.88 **1808**

Projection-Television Receiver: Part 3—The 25-kV Anode Voltage Supply Unit.—G. J. Siezen & F. Kerkhof. (*Philips tech. Rev.*, Nov. 1948, Vol. 10, No. 5, pp. 125–134.) Part 1 : 1215 of April. Part 2: 1836 below. For another account see 2387 of 1948.

621.314.6 + 621.315.59 + 621.396.622 + 621.383 **1809**

German Research on Semi-Conductors, Metal Rectifiers, Detectors and Photocells. [Book Notice]—(*See* 1700.)

TELEVISION AND PHOTOTELEGRAPHY

621.397 **1810**

1949 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 160–178.) Abstracts are given of the following papers read at the convention:—6. Factors involved in the Design of an Improved Frequency-Shift Receiving System [for naval facsimile], by C. C. Rae. 20. The Technique of Television Sound, by R. H. Tanner. 42. V.H.F. Television—Propagation Aspects, by E. W. Allen, Jr. 64. A Method of Multiple Operation of Transmitter Tubes particularly adapted for Television Transmission in the U.H.F. Band, by G. H. Brown, W. C. Morrison, W. L. Behrend & J. G. Reddeck. 65. Transient-Response Tests on the WPTZ Television Transmitter, by R. C. Moore. 66. Television Transmitter Carrier Synchronization, by R. D. Kell. 67. Television by Pulse-Code Modulation, by W. M. Goodall. 83. The Measurement of the Modulation Depth of Television Signals, by R. P. Burr. 84. Development and Performance of Television Camera Tubes, by R. P. Janes, R. E. Johnson & R. S. Moore. 85. An Anastigmatic Yoke for Television Deflection, by K. Schlesinger. 86. A High-Efficiency Sweep Circuit, by B. M. Oliver. 87. Current Developments in U.H.F. Television, by T. T. Goldsmith, Jr. 112. Intercity Television Radio Relays, by W. H. Forster. 113. Video Design Considerations in a Television Link, by M. Silver, H. French & L. Staschover. 140. The Graphechon—A Picture-Storage Tube, by L. Pensak. Titles of other papers are given in other sections.

621.397.62 **1811**

Superheterodyne Television Unit.—(*Wireless World*, March 1949, Vol. 55, No. 3, pp. 97–102.) Continuation of 1527 of May. Mechanical details and alignment are discussed.

621.397.62 : 535.88 : 621.385.832 **1812**

Projection-Television Receiver: Part 2 — The Cathode-Ray Tube.—de Gier. (*See* 1836.)

621.397.62 : 535.88 : 621.396.68 **1813**

Projection-Television Receiver: Part 3 — The 25-kV Anode Voltage Supply Unit.—Siezen & Kerkhof. (*See* 1808.)

621.397.62 : 656.22 **1814**

Train Television.—F. R. Norton, C. G. McMullen & G. L. Haugen. (*Electronics*, March 1949, Vol. 22, No. 3, pp. 100–101.) Two sizes of folded dipole, with ends bent back, are used. This arrangement is more satisfactory than ring aerials. A normal type of 12-channel receiver has a special double-clamp a.g.c. circuit which improves synchronization considerably. Power supply difficulties are mentioned.

621.397.645 **1815**

On the Design of Television Intermediate-Frequency Amplifiers.—Sokolov. (*See* 1635.)

621.397.7 + 621.396.712.3 **1816**

Planning Radio and Television Studios.—Nixon. (*See* 1795.)

621.397.7 **1817**

Practical Equipment Layouts for Television Stations.—(*Broadcast News*, Dec. 1948, No. 52, pp. 12–39.) Illustrated discussion of the requirements for stations of various types.

621.397.743 : 621.315.212 **1818**

Coaxial Cable Joins East and Mid-West TV Networks.—Hertzberg. (*See* 1581.)

621.397.5 **1819**

Six Papers on Television (Translation). [Book Notice]—F.I.A.T. Final Report 865 (Supplement). H.M. Stationery Office, London, 74 pp., 7s. The papers are entitled: 1. New Scanning Method for Television. 2. Phase Modulation for Television. 3. Channeling by Time Division on a Wide-Band Carrier. 4. Apartment-House Television Distribution. 5. Code-Modulated Telephony. 6. Multiplex Code-Modulated Telephony. All these papers are by F. Schröter; they are preceded by a preface briefly describing recent advances in television techniques.

TRANSMISSION

621.396.61 **1820**

Broadcasting Transmitters at Villebon, Rennes and Lille.—H. Campet. (*Ann. Radioélect.*, Jan. 1949, Vol. 4, No. 15, pp. 85–88.) The amplitude/phase method of modulation used in these three reconditioned stations is described and performance figures for the Lille transmitter are given.

621.396.61 **1821**

Daily Routine of the Sottens [broadcasting] **Transmitter.**—R. Pièce. (*Bull. schweiz. elektrotech. Ver.*, 26th Jan. 1946, Vol. 37, No. 2, pp. 31–39. In French.) A short description of the quartz-controlled 100-kW 677-kc/s equipment, with an outline of the functions of the staff and discussion of service faults due to external and internal causes.

621.396.619, **1822**

1949 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 160–178.) Abstracts are given of papers read at the convention, including:—111. Synchrodyne Modulation of Klystrons, by V. Learned. Titles of other papers are given in other sections.

621.396.619.13 **1823**

Impedance Valves for Frequency Modulation.—H. Klauser. (*Bull. schweiz. elektrotech. Ver.*, 19th Oct. 1946, Vol. 37, No. 21, pp. 624–627. In German, with French summary.) The mode of operation of such devices, particularly for f.m. of transmitters, is explained and equivalent circuits are discussed, two of which give controllable capacitance and two controllable inductance, one of each pair being loss free. The conditions for distortionless modulation are considered for both capacitive and inductive impedance valves. For a given frequency it is possible, under certain conditions, to suppress the a.m. which is produced together with the f.m.

VALVES AND THERMIONICS

621.385 + 621.396.615 **1824**

1949 I.R.E. National Convention Program.—(*Proc. Inst. Radio Engrs, W. & E.*, Feb. 1949, Vol. 37, No. 2, pp. 160–178.) Abstracts are given of the following papers read at the convention :—10. A Broad-Band Transition from Coax to Helix, by C. O. Lund. 55. The Type 5811 and Type 5807 Tubes—the Smallest Commercial Pentode Amplifiers, by L. G. Hector & H. R. Jacobus. 58. Electrometer Tubes and Circuits, by H.F. Starke. 78. Microphonism Investigation, by L. Feinstein. 79. A Critical Survey of Methods of Making Ceramic-to-Metal Seals and Their Use for Electron-Tube Construction, by R. P. Wellinger. 80. Rugged Tubes, by G. W. Baker. 81. An Improved Method of Testing for Residual Gas in Electron Tubes and Vacuum Systems, by E. W. Herold. 82. Design Factors, Processes, and Materials for the Envelope of a Metal Kinescope, by R. D. Faulkner & J. C. Turnbull. 105. The Effects of Various Barium Compounds with respect to

Cold-Cathode Behavior as a function of Life in a Glow Discharge, by H. Jacobs & A. P. LaRocque. 106. Oxide-Cathode Properties and their Effects on Diode Operation at Small Signals, by G. C. Dalman. 107. Microanalysis of Gas in Cathode-Coating Assemblies, by H. Jacobs & B. Wolk. 108. Exposure of Secondary-Electron-Emitting Surfaces to the Evaporation from Oxide Cathodes, by C. W. Mueller. 109. The Use of Thoriated-Tungsten Filaments in High-Power Transmitting Tubes, by R. B. Ayer. 120. General Solution of the Two-Beam Electron Wave-Tube Equation, by A. V. Haeff, H. D. Arnett & W. Stein. 124. Space-Charge Effects and Frequency Characteristics of C. W. Magnetrons relative to the problem of Frequency Modulation, by H. W. Welch, Jr. 140. The Graphechon—A Picture-Storage Tube, by L. Pensak. 141. The Pencil-Type U.H.F. Triode, by G. M. Rose & D. W. Power. 142. Practical Applications of the Resnatron in the High-Power Transmitter Field, by W. W. Salisbury. 143. The Electron Coupler—A Developmental Tube, utilizing New Principles, for the Modulation and Control of Power at U.H.F., by C. L. Cuccia & J. S. Donal, Jr. 144. A Wide-Tuning-Range Low-Power C.W. Magnetron, by L. R. Bloom & W. W. Cannon. Titles of other papers are given in other sections.

621.385 **1825**

The Electron-Wave Tube — A Novel Method of Generation and Amplification of Microwave Energy.—A. V. Haeff. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1949, Vol. 37, No. 1, pp. 4–10.) Beams of electrons moving with different mean velocities are allowed to mix. Interchange of energy takes place, resulting in negative attenuation characteristics. Oscillators and amplifiers for microwave frequencies may thus be constructed without resonant structures of small dimensions.

The paper gives a mathematical analysis of the two-velocity case, and indicates how to extend the results to multiple and continuous velocity distributions. It is shown that amplification is obtained for a limited range of values of stream inhomogeneity.

Experimental valves of two-velocity and space-charge types are described. A comparison of experimental and theoretical gain curves shows good agreement. Gains of the order of 80 db at 3 000 Mc/s and electronic bandwidths of over 30% have been observed. The new method is likely to have important applications to valves for millimetre waves. See also 1540 of May (Nergaard).

621.385 **1826**

The Development and Design of Cooled-Anode Valves.—F. Smith. (*Proc. Instn elect. Engrs*, Part III, Jan. 1949, Vol. 96, No. 39, pp. 1–4.) Long summary of Radio Section Chairman's address.

621.385 **1827**

Trends in Electron Tube Design.—W. C. White. (*Elect. Engng, N.Y.*, June 1948, Vol. 67, No. 6, pp. 517–530.) A comprehensive survey of modern practices and developments in the construction of all types of valve.

621.385 : 621.392.2 **1828**

Study of the Propagation of an Electromagnetic Wave in the Presence of Two Electron Beams of Neighbouring Velocities.—Lapostolle. (*See* 1583.)

621.385 : 666.11 : 621.315.612.011.5 **1829**

Contribution to the Study of the Electrical Properties of Glasses used in the Construction of Radio Valves.—Meunier. (*See* 1699.)

621.385.029.63/.64 : 621.396.615 **1830**

Travelling-Wave Valves as Oscillators with Wide-Band Electronic Tuning.—O. Doehler, W. Kleen & P. Palluel. (*Ann. Radioélect.*, Jan. 1949, Vol. 4, No. 15, pp. 68–75.) Self-oscillation due to internal feedback is discussed. For valves in which the delay line gives an attenuation sufficient to suppress all possibility of internal feedback, external feedback may be applied by means of a waveguide coupling the valve output to the input. In this case the tuning band is about double that obtained with internal feedback and may be of the order of 10% for a frequency of 3 000 Mc/s and 2.5% for 24 000 Mc/s. For travelling-wave valves with a central conductor provided with a system of equidistant circular fins, and in which the electron beam passes through the space between the edges of the fins and the outer wall of the valve, output power is high. At 3 000 Mc/s this may be of the order of 20 W, at 9 000 Mc/s about 1–2 W and at 24 000 Mc/s about 0.1–0.2 W.

621.385.032.24 : 621.396.645 **1831**

Practical Notes on Grid Current and Neutralisation.—F. Dickson. (*Philips tech. Commun., Aust.*, Sept./Oct. 1948, No. 7, pp. 3–6.)

621.385.2 : 621.396.822 **1832**

The Behaviour of a Diode Noise Generator at Ultra High Frequencies.—A. W. Love. (*J. Instn Engrs Aust.*, Dec. 1948, Vol. 20, No. 12, p. 201.) Discussion on 567 of February.

621.385.3.012 **1833**

Factors Influencing the Perveance of Power-Output Triodes.—G. R. Partridge. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1949, Vol. 37, No. 1, pp. 87–94.) Perveance is a factor relating anode voltage and current. Several formulae for perveance and for cathode current are listed and discussed.

621.385.38 **1834**

A New Line of Thyratrons.—A. W. Coolidge, Jr. (*Elect. Engng, N.Y.*, May 1948, Vol. 67, No. 5, p. 435.) Long summary of A.I.E.E. paper. Description of the GL-5545 gasfilled thyratron, which is claimed to have 10 times the life of other gasfilled thyratrons. The GL-5545 seldom requires a series RC circuit (snubber) for industrial applications.

621.385.4.032.2 **1835**

The Anode to Screen Grid Space in Beam Tetrode.—Chai Yeh. (*Science Rec., Nanking*, Oct. 1947, Vol. 2, No. 1, pp. 57–62. In English.)

621.385.832 : 621.397.62 : 535.88 **1836**

Projection-Television Receiver : Part 2 — The Cathode-Ray Tube.—J. de Gier. (*Philips tech. Rev.*, Oct. 1948, Vol. 10, No. 4, pp. 97–104.) Part 1: 1215 of April. Part 3: 1808 above. For another account see 2387 of 1948.

621.383 + 621.315.59 + 621.314.6 + 621.396.622 **1837**

German Research on Semi-Conductors, Metal Rectifiers, Detectors and Photocells. [Book Notice]—(*See* 1700.)

MISCELLANEOUS

621.396 **1838**

Fundamentals of Electric Waves. [Book Review]—H. H. Skilling. J. Wiley & Sons, New York; Chapman & Hall, London, 2nd edn 1948, 245 pp., $4.00. (*J. Franklin Inst.*, Jan. 1949, Vol. 247, No. 1, p. 80.) An elementary text on e.m. theory, illustrating its application to related items such as aerials and waveguides. Vector notation is explained and used. Considerable revision of the first edition (noted in 319 and 2027 of 1943) has taken place.

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

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ACOUSTICS AND AUDIO FREQUENCIES

534.21 **1839**

On the Sound Field produced by a Point Source with Uniform Rectilinear Ultrasonic Velocity in a Perfect Fluid.—P. Liénard. (*C. R. Acad. Sci., Paris*, 14th March 1949, Vol. 228, No. 11, pp. 910–912.)

534.22 : 534.321.9 **1840**

Experimental Determination of Velocity of Sound in Superheated Steam by Ultrasonics.—J. Woodburn. (*Trans. Amer. Soc. mech. Engrs*, Jan. 1949, Vol. 71, No. 1, pp. 65–70. Discussion, pp. 70–72.) The frequency of a quartz crystal source and the length of standing waves generated in a cylinder containing the steam were measured. Results agree closely with data calculated from the steam tables of Keenan and Keyes.

534.232 **1841**

Coupled Mechano-Acoustic Oscillators and Resonators.—F. A. Fischer. (*Frequenz*, Sept. 1948, Vol. 2, No. 9, pp. 232–238.) Discussion, by means of electrical analogies, of the type of oscillator termed 'Tonpilz' [literally 'sonic mushroom'] by Hahnemann & Hecht (see *Phys. Z.*, 1920, Vol. 21, pp. 187–192 & 1921, Vol. 22, pp. 353–360) and consisting simply of two masses connected by a spring and a damping device. The coupling of two such systems is exemplified in the well-known Fessenden oscillator. Reciprocal arrangements, in which two resonators are connected by a neck, are also considered.

534.321.9 **1842**

Experimental Ultrasonics : Parts 1 & 2.—S. Y. White. (*Audio Engng, N.Y.*, March & April 1949, Vol. 33, Nos. 3 & 4, pp. 20–23 .. 45 & 24–25 .. 41.) Part 1 : Design, construction and operation of the Hartmann whistle. Part 2 : Discussion of small pickups such as those used for probes, with due allowance for the wide frequency range normally required.

534.321.9 : 537.228.2 **1843**

Ultrasonics and Electrostriction.—H. Falkenhagen. (*Z. angew. Phys.*, March 1949, Vol. 1, No. 7, pp. 304–306.) Discussion of various possible methods of using electrostriction in ultrasonic transmitters and receivers.

534.41 : 534.78 **1844**

A Photoelectric Type of Acoustic Spectrograph using Sound Film.—D. Brown, C. F. Coleman & J. W. Lyttleton. (*Proc. phys. Soc.*, 1st March 1949, Vol. 62, No. 351B, pp. 149–162.) An optical method in which a continuously moving sound film is analysed by means of a frequency-scanning disk; the resulting oscillograph pattern is photographed on another moving film. Typical analyses, mainly speech patterns, are reproduced and discussed. Advantages include the ability to record the amplitude and phase of each component, and to change the analysing convention in any desired manner. Resolving power, spectral line profiles and amplifier bandwidth requirements are also considered.

534.43 : 621.395.813 **1845**

Cost *vs* Quality in A.F. Circuits.—J. M. Van Beuren. (*FM-TV*, Feb. 1949, Vol. 9, No. 2, pp. 31–32, 34.) "Carefully-chosen components and well-designed circuits can give a big improvement [in quality] at very small cost." Three high-quality a.f. amplifiers are discussed, with diagrams and component details.

534.76 : 621.395.625.6 **1846**

Experiment in Stereophonic Sound.—L. D. Grignon. (*J. Soc. Mot. Pict. Engrs*, March 1949, Vol. 52, No. 3, pp. 280–292. Discussion, p. 292.) S.M.P.E. 1948 Convention paper. Discussion of the special microphone technique required for recording for reproduction in a cinema. Essentially the same paper is reproduced in *FM-TV*, April 1949, Vol. 9, No. 4, pp. 28–30.

534.78 : 621.396.619.13/.14 **1847**

Ratio of Frequency Swing to Phase Swing in Phase- and Frequency-Modulation Systems Transmitting Speech.—Gannett & Young. (*See* 2048.)

534.83 **1848**

Noise and its Measurement.—H. G. M. Spratt. (*Elect. Rev., Lond.*, 8th April 1949, Vol. 144, No. 3724, pp. 565–567.) A short account of the principal features and functions of the sound-level meter Type 1400, a.f. analyser Type 1401, and vibration meter Type 1402, made by the Dawe Instrument Co.

534.844.4 **1849**

A Comparison of the Acoustics of the Philharmonic Hall, Liverpool, and St. Andrew's Grand Hall, Glasgow.—T. Somerville. (*B.B.C. Quart.*, April 1949, Vol. 4, No. 1, pp. 41–54.) The acoustic properties of the halls are expressed in terms of reverberation time, and various methods are discussed for measuring this quantity, which depends on the frequency of measurement and the alignment of the directional microphone used. The results are correlated with the constructional details of the halls, and with subjective observations.

534.845 **1850**

On the Theory of the Reflection of Sound by Porous Media.—J. Korringa, R. Kronig & A. Smit. (*Physica, 's Grav.*, Dec. 1945, Vol. 11, No. 4, pp. 209–230. In English.) An extension of recent investigations by Zwikker and his collaborators (3321–3324 of 1948) to a medium consisting of a large number of identical rigid spheres, with infinite heat capacity and thermal conductivity, arranged in a cubic lattice.

534.86 : 621.397.5 **1851**

Audio Technique in Television Broadcasting.—R. H. Tanner. (*Audio Engng, N.Y.*, March 1949, Vol. 33, No. 3, pp. 9–13 . . 44.)

621.395.61/.62 **1852**

Considerations on Electroacoustic Transducers and some Conclusions, with Practical Examples.—W. Bürck. (*Funk u. Ton*, April 1949, Vol. 3, No. 4, pp. 187–201.) General theory of electrodynamic, e.m. and e.s. devices, with particular reference to efficiency. The conclusions are applied to discussion of the dynamic loudspeaker and the dynamic microphone.

621.395.61 **1853**

An Omnidirectional Microphone.—J. K. Hilliard. (*Audio Engng, N.Y.*, April 1949, Vol. 33, No. 4, pp. 20–21.) The microphone is 0.6 in. in diameter and 0.4 in. thick ; it weighs less than $\frac{1}{3}$ oz. It is based on e.s. rather than e.m. principles and is little affected by blast, iron filing damage, or magnetic induction. In sound reinforcement applications, 4 db more gain is obtainable than with other non-directional microphones.

621.395.61 **1854**

Single-Element Unidirectional Microphone.—H. F. Olson & J. Preston. (*J. Soc. Mot. Pict. Engrs*, March 1949, Vol. 52, No. 3, pp. 293–302.) Developed for use in sound-film recording, with the following characteristics: single-ribbon type; the back of the ribbon is coupled to a damped folded pipe and an acoustical impedance in the form of an aperture; improved cardioid directional pattern; increased output; reduced weight; reduced wind-noise response.

621.395.623.7 **1855**

Modern Loudspeaker Technique.—M. Alixant. (*Radio tech. Dig., Édn franç.*, April 1949, Vol. 3, No. 2, pp. 83–99. Bibliography, pp. 99–101.) A short discussion of the fundamental theory of electrodynamic loudspeakers, with tabulated data for the principal permanent-magnet alloys and lists giving some details of permanent-magnet and e.m. loudspeakers manufactured in France. Modern types of American and British loudspeakers are briefly reviewed.

621.395.625.2 : 621.396.712 **1856**

Disc Recording for Broadcast Stations.—W. J. Mahoney. (*Audio Engng, N.Y.*, April 1949, Vol. 33, No. 4, pp. 9–13 . . 46.) Discussion of the system designed for new studios at WSAI, Cincinnati, and of the practical problems involved in designing a complex system of recording equalizers.

AERIALS AND TRANSMISSION LINES

621.315.212 : 621.397.5 **1857**

The London-Birmingham Television Cable : Part 2 — Cable Design, Construction and Test Results.—H. Stanesby & W. K. Weston. (*P.O. elect. Engrs' J.*, April 1949, Vol. 42, Part 1, pp. 33–38.) Details of the experimental work on the design and manufacture of the cable, the production of factory lengths, and the jointing technique used for completing repeater sections. Test results on typical sections are also discussed. Part 1: 1279 of May.

621.392.26† **1858**

Reflection of H_1 Waves at a Sudden Change of the Cross-Section of a Rectangular Waveguide.—K. Fränz. (*Frequenz*, Sept. 1948, Vol. 2, No. 9, pp. 227–231.) A formula for the reflection coefficient is derived which depends on the waveguide dimensions and is analogous to that for reflection at the junction of two parallel Lecher-wire systems of the same breadth but with their ends at different levels. At the reflection point a local capacitive field exists.

621.396.67 **1859**

The General Problem of Antenna Radiation and the Fundamental Integral Equation, with Application to an Antenna of Revolution: Parts 1 & 2.—G. E. Albert & J. L. Synge; J. L. Synge. (*Quart. appl. Math.*, July 1948, Vol. 6, No. 2, pp. 117–156.) Part 1: Radiation in a finite cavity is discussed, and an integral equation is obtained which has the same form as the basic integral equation for an aerial. The latter equation reduces to a simple explicit form for an aerial with axial symmetry. The application of the results to actual radiating systems is discussed. Part 2: The importance of the gap is emphasized; for a fuller investigation see 24 of 1948 (Infeld). Thin aerials are considered; the current is shown to be approximately sinusoidal outside the gap. A shape term is included for the case when the gap is not at the centre, and is calculated explicitly for certain simple shapes. A method of successive approximations is also described for dealing with any aerial, thin or thick.

621.396.67 **1860**

The Helical Antenna.—J. D. Kraus. (*Proc. Inst. Radio Engrs, W. & E.*, March 1949, Vol. 37, No. 3, pp. 263–272.) The helix is considered as a fundamental form of aerial and the variation of radiation pattern and type of polarization with change in helix dimensions are discussed. For the axial mode the radiation pattern and terminal impedance are maintained over a wide frequency range.

621.396.67 **1861**

A V.H.F. Helical Beam Antenna.—H. E. Taylor & D. Fowler. (*CQ*, April 1949, Vol. 5, No. 4, pp. 13–16.) Design details for an aerial for the 144–148-Mc/s range, with circular polarization and gain of 11.5–13 db.

621.396.67 **1862**

Optimum Design of a Cylindroparabolic Reflector.—G. Klages. (*Frequenz*, June 1948, Vol. 2, No. 6, pp. 151–154.) The Kirchhoff-Huyghens principle is used to calculate the zones on the surface of the reflector which reduce, by interference, the radiation along the axis. The formulae obtained enable reflectors to be designed with optimum gain.

621.396.67 : 538.56 : 535.13 **1863**

The Radiation and Transmission Properties of a Pair of Semi-Infinite Parallel Plates : Part 1.—Heins. (*See* 1920.)

621.396.67 : 621.396.11 **1864**

Ground Absorption with Elevated Vertical and Horizontal Dipoles.—R. E. Burgess. (*Wireless Engr*, April 1949, Vol. 26, No. 307, pp. 133–139.) The fraction of the power absorbed in the ground is calculated for dipole heights which are large compared with the wavelength. The dipole is assumed to have a sine-law polar diagram and the energy flow into the ground is evaluated using the Fresnel reflection coefficients which depend upon the wave polarization. The absorption factors are determined for limiting values of ground permittivity. The ground absorption for a vertical dipole is a very slowly varying function of the electrical properties of the ground and is very nearly 0.4 for most practical conditions. It is appreciably greater than that of a horizontal dipole on account of the Brewster phenomenon. The results obtained are compared with those derived earlier by Strutt, Niessen and Sommerfeld & Renner.

The noise in an aerial system due to thermal radiation from the ground is evaluated directly using thermodynamical principles and is shown to be consistent with the value derived by application of the reciprocity principle.

Brief consideration is given to the ground absorption for aerial arrays.

621.396.671 **1865**

Driving Point Impedance of a Vertical Cylindrical Radiator and Concentric Ring of Subsidiary Radiators over Perfectly Conducting Earth : Parts 1 & 2.—H. Cafferata. (*Marconi Rev.*, Jan./March & April/June 1949, Vol. 12, Nos. 92 & 93, pp. 12–20 & 57–67.) Hallén's integral equation method is applied, with particular reference to an approximate solution for the case of 3 small subsidiary radiators symmetrically arranged round the main aerial and with base connections to it, the radius of the ring being small compared with λ. See also 854 of 1946 (Harrison).

621.396.671 **1866**

Measurement of Gain of Electromagnetic Horns.—A. S. Dunbar & M. D. Adcock. (*J. appl. Phys.*, Feb. 1949, Vol. 20, No. 2, pp. 226–227.) Criticism of 1600 of June (Watson & McKinney), and discussion of an alternative method involving measurement only of the ratio of received to transmitted power.

621.396.671 **1867**

Mutual Impedance of Parallel Aerials.—G. Barzilai. (*Wireless Engr*, Feb. 1949, Vol. 26, No. 305, p. 73.) Corrections to 648 of March.

621.396.677 **1868**

Metallic Delay Lenses.—S. S. D. Jones & J. Brown. (*Nature, Lond.*, 26th Feb. 1949, Vol. 163, No. 4139, pp. 324–325.) Kock's formula (2176 of 1948) for the refractive index n is found experimentally to give a value 18% too low. The new formula

$$n^2 = 1 + (2d/\pi a)\log_e \operatorname{cosec}(\pi b/2d),$$

where a, b and d are dimensions of the lens structure, is based on the assumption that the refracting medium behaves like a transmission line. The formula is valid for the wavelength range within which n is constant. Observed values of n agree with those predicted by this formula within the limits of experimental accuracy.

621.396.677 **1869**

Directional Antenna for the 152-162-Mc/s Communications Band.—J. S. Brown & V. J. Moffatt. (*Communications*, March 1949, Vol. 29, No. 3, pp. 14–16, 35.) A corner-reflector type with vertical polarization, in which two sets of parallel rods, spaced 0.1 λ apart in two vertical planes, are used instead of metal sheets. It has a unidirectional radiation pattern, a gain of at least 6 db over a λ/2 dipole and a voltage s.w.r. <1.5 over the whole frequency band. The feeder cable can have any impedance between 50 and 75 Ω.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.015.3 : 621.314.6 **1870**

Voltage Surges produced in Rectifiers by Starting without Load.—T. Douma. (*Communication News*, Aug. 1948, Vol. 9, No. 4, pp. 121–125.) If a h.v. rectifier with low damping is started without load, voltage surges up to four times the peak transformer voltage can occur across the valves, and the voltage on the smoothing capacitors can be twice the peak alternating voltage of the transformer. These surge voltages are at least double those encountered under normal operating conditions. They can be avoided by applying damping to the input choke and providing the smoothing capacitors with a suitable series resistance which can be short-circuited after the rectifier has been switched on.

621.3.09 : 621.397.5 **1871**

Attenuation and Phase Distortion and their Effect on Television Signals.—G. Fuchs & V. Baranov. (*Câbles & Transmission, Paris*, April 1949, Vol. 3, No. 2, pp. 194–207.) An examination of the relations between small attenuation and phase distortions and the deformation of the response curve of a television receiver. In one method the distortion/frequency characteristic is treated as a whole, while in a second method this characteristic is split up into a certain number of elementary sections. Practical limits for these distortions are calculated and the theoretical results are applied to 450-line and 1 100-line television systems.

621.314.2.012.8 **1872**

The Transformer and its Equivalent Representation.—P. G. Violet. (*Frequenz*, Jan. 1949, Vol. 3, No. 1, pp. 1–12.) A general treatment based on quadripole theory. Matrices for the ordinary and the ideal transformer are given and the various equivalent schemes are explained and compared. The application of circuit equivalents for measurement purposes and for filter calculations is considered, in particular for filters whose branches consist of oscillatory circuits. The equivalents for transformers with two secondary windings are given and comparison is made with the normal single-secondary transformer.

621.314.3† **1873**

The Basic Considerations in the Design of Push-Pull Magnetic Amplifiers.—M. A. Rozenblat. (*Avtomatika i Telemekhanika*, Jan./Feb. 1949, Vol. 10, No. 1, pp. 32–50. In Russian.) Discussion of amplifiers of the differential, bridge and transformer types (Figs 1, 2 and 3 respectively) with loads taking a.c. Their operation is discussed and the conditions for obtaining maximum values of both power output and amplification factor are established. Methods are indicated for determining the optimum operating conditions for a given core material. An example of the design procedure is given, together with experimental results for the amplifier so designed.

621.316.86 **1874**

Cracked-Carbon Resistors.—R. W. Wilton. (*FM-TV*, Feb. 1949, Vol. 9, No. 2, p. 29.) Brief discussion of the characteristics of resistors made by the Welwyn Electrical Laboratories, by the pyrolitic process of depositing carbon on porcelain. Nonlinearity hardly exists. The resistance value is controlled by the cracking temperature, the hydrocarbon content of the gas mixture, and the time of exposure of the rod in the cracking zone. Such resistors are cheaper than wire-wound resistors for ratings up to 2–4 W, and inductive effects are almost absent from high-value resistances, for which helical grooves may be used. Resistance values are accurate within ± 1%, voltage and temperature coefficients are low, and long-term stability is high. High-gain amplifiers using these resistors have little high-level hiss.

621.316.86 **1875**

Results of an Investigation of the Volt-Ampere Characteristic of some Nonlinear Resistors.—M. A. Topchibashev. (*Avtomatika i Telemekhanika,* Jan./Feb. 1949, Vol. 10, No. 1, pp. 13–24. In Russian.) The division of nonlinear resistors into two main groups (varistors and thermistors) is considered ; their properties can be best represented by their volt-ampere characteristics. The equation describing these is of the form $I = AV^{\alpha}$ where A is called the coefficient of nonlinearity and α the index of nonlinearity. Analytical and graphical methods for determining A and α are discussed. Results of an experimental investigation of a number of these resistors are summarized in two comprehensive tables showing A, α and the maximum errors for given voltage ranges.

621.318.42 **1876**

Axial Field and Supplementary Losses of Inductance Coils without Iron.—J. Rezelman. (*Rev. gén. Élect.,* April 1949, Vol. 58, No. 4, pp. 154–162.) Formulae and curves are given for circular coils of rectangular winding cross-section, with experimental results.

621.318.572 **1877**

A New Pulse-Amplitude Discriminator Circuit.—E. H. Cooke-Yarborough. (*J. sci. Instrum.,* March 1949, Vol. 26, No. 3, pp. 96–97.) The circuit described discriminates against pulses smaller than those to be counted. The dead time is a known constant, so that counting losses can be accurately determined without complete knowledge of the resolving time of other equipment in the counting chain. These counting losses are calculated and the condition for the counting rate to be independent of the input pulse width is deduced.

621.318.572 : 621.396.1 **1878**

An Electronic Switch for Diversity Reception.—H. V. Griffiths & R. W. Bayliff. (*B.B.C. Quart.,* April 1949, Vol. 4, No. 1, pp. 57–64.) The dual-diversity switch has a discriminator which monitors the signals received on two receivers and controls a gating circuit which blocks the output from the receiver carrying the weaker signal and passes that from the receiver carrying the stronger signal. Circuit details are given of this switch and of a similar device for operation with three receivers (triple-diversity).

621.319 : 679.5 **1879**

Design and Performance Characteristics of "Electrets".—E. D. Padgett. (*Tele-Tech,* March 1949, Vol. 8, No. 3, pp. 36–39 . . 63.) See also 1307 of May.

621.319.4 **1880**

Capacitors with Cylinders of Different Expansion Coefficients for Compensation of the Dependence of Capacitance on Temperature.—A. Rohrmann. (*Funk u. Ton,* April 1949, Vol. 3, No. 4, pp. 230–233.) Design formulae are given, with numerical examples and tabulated temperature coefficients of capacitance for capacitors with outer cylinder of brass (37% Zn) and inner cylinder either of copper or of brass with Zn content ranging from 28.1% to 37%. The coefficient is zero for a capacitor with Cu inner cylinder and radii ratio of 1.164, and also for one with brass inner cylinder (31.1% Zn) and radii ratio of 1.02.

621.319.4 : 621.315.59 **1881**

On the Use of Semiconducting Liquids for Impregnating Paper Capacitors.—Renne. (*See* 1969.)

621.392 **1882**

General Impedance-Function Theory.—P. I. Richards. (*Quart. appl. Math.,* April 1948, Vol. 6, No. 1, pp. 21–29.) Discussion of methods of extending lumped-constant impedance-function theory to distributed-constant circuits.

621.392 : 621.396.619.13 **1883**

A Simple Method of Calculation for Electrical Circuits carrying Frequency-Modulated Voltages.—J. W. Alexander. (*Communication News,* Dec. 1947, Vol. 9, No. 2, pp. 33–38.) An approximate simplification of Vellat's method (79 of 1942), accurate in general within 10% for the final result. The important parameters governing the accuracy are the 'swing-factor', or ratio of the maximum frequency deviation to the maximum modulation frequency, and the bandwidth factor, or ratio of the bandwidth to the double swing. Calculations are made as for a circuit in which the voltage varies sinusoidally at frequency f, and f is replaced by the instantaneous frequency in the final result. The distortion for a tuned circuit with and without limiter, and for a band-pass filter, is calculated by this and by other methods and the results are compared.

621.392.43 **1884**

A Balanced-to-Unbalanced Matching Unit for High Frequencies.—J. W. Whitehead. (*J. sci. Instrum.,* March 1949, Vol. 26, No. 3, pp. 71–73.) A circuit for matching an unbalanced circuit to a balanced resistive circuit is investigated theoretically and practically. Component values for a particular case are derived. Experimental units on the same principles have been built with certain inductances and capacitances variable; they have been used successfully with a 3.5-kW transmitter throughout the frequency range 2.5–20 Mc/s. These units can easily be constructed, and adjustments for large changes of frequency can quickly be made since coil changing is unnecessary.

621.392.43 **1885**

Impedance Transformation by Means of Cables.—W. Burkhardtsmaier. (*Funk u. Ton,* March & April 1949, Vol. 3, Nos. 3 & 4, pp. 151–167 & 202–213.) Discussion of the use of sections of cable, with characteristic impedance variable along their length, as impedance transformers. Two types are considered ; in the first the impedance varies stepwise from one end to the other, while in the second the impedance variation is uniform. Such transformers can be used with advantage not only for long and medium waves, but also for short waves if suitably designed. Design formulae are derived and practical types of equipment for concentric cables and twin conductors are described. In many cases better results can be obtained by the addition of compensation units at each end of the transformer section. The design of such units is also considered.

621.392.5 **1886**

On the Synthesis of the Most General Passive Quadripoles.—R. Leroy. (*Câbles & Transmission, Paris,* April 1949, Vol. 3, No. 2, pp. 141–158.) The matrices of the impedances or admittances of passive quadripoles are 'positive real' matrices. The construction of quadripoles from such matrices is straightforward when their elements comprise only two types of impedance, but this is not the case when the matrices include resistances, inductances and also capacitances. The possibility of obtaining passive quadripoles corresponding to such matrices was shown by Gewertz (*J.*

Math. Phys., 1932–1933, Vol. 12, pp. 1–254) whose paper appears to-day to be largely ignored by technicians. Gewertz studies a particular class of matrices in which the determinant of the even parts of the elements is zero and for which he gives a method of reduction. He also shows that the representation of every 'positive real' matrix can be referred to a matrix of this class.

The present paper, by more systematic application of the theory of functions and of 'positive real' matrices, simplifies the results of Gewertz and gives physical reasons for certain properties, sometimes established by formal calculus, which may not appear altogether satisfactory. Gewertz' method is also applied to the realization of effective impedances. See also 2539 of 1940, 1627 and 3017 of 1941 (Cauer).

621.392.5 **1887**

Reactive Ladder Networks.—J. Ville. (*Câbles & Transmission, Paris*, April 1949, Vol. 3, No. 2, pp. 159–176.) A theoretical analysis based on the properties of the input impedance of ladder networks terminated by an ohmic resistance. This impedance only defines a network with a limited number of cells which are all-pass. All-pass cells which cannot be realized by ladder construction are essentially of the lattice type.

Systematic use is made of shunt frequencies, for which the shunt arms of the ladder network are short-circuited, cutting out the terminal ohmic resistance; the input impedance then resembles a reactance and the shunt frequencies can therefore be determined *a priori* by finding the frequencies for which the input impedance has the properties of a reactance. The shunt frequencies are roots of the equation whose first member is obtained by equating to zero the even part of the input impedance. Comment on certain parts of the paper is made by R. Leroy. See also 2190 of 1948 and 1886 above (Leroy).

621.392.52 **1888**

Introduction to the Operating-Parameter Theory of Filter Calculation.—C. Wisspeintner. (*Frequenz*, May–Aug. 1948, Vol. 2, Nos. 5–8, pp. 131–140, 154–163, 190–199 & 210–214.) The principal results of the mathematical theory of filters are presented in as simple a form as possible to make them readily available to the practical engineer. Quadripole theory is first considered and in this the usual complex quantities are denoted by German characters, while Roman type is used in the treatment of the operating-parameter theory. The wave-parameter theory of quadripoles includes discussion of the properties of various types of filter. In practice it is seldom possible to terminate a filter with its characteristic impedance and in consequence reflections occur which affect the attenuation both within and outside the pass band. The operating-parameter theory takes account of such reflections. The relation between overall, current and voltage attenuation is discussed and also echo attenuation. The determination of the no-load resistance for a given attenuation is explained in detail with the aid of numerous diagrams. Application of the theory is illustrated by numerical calculations for many different types of filter. Results for a particular band-pass filter are in fairly good agreement with measurements.

621.392.52 **1889**

Variable Bandwidth Crystal Filters.—B. Sandel. (*Radiotronics*, Sept./Oct. 1948, No. 133, pp. 78–87.) The behaviour of the equivalent circuit of a quartz crystal is discussed. For best overall selectivity, the shunt capacitance in this circuit should be neutralized; practical arrangements for achieving this are described. To vary the bandwidth, a tuned circuit should be used as the load for the filter; the dynamic impedance of this circuit can be altered by the insertion of series or parallel resistors. The stage gain is calculated, with due allowance for bandwidth change. A design example is discussed in detail.

621.392.52 **1890**

The Input Impedance of Some Low Pass Filters with Resistance Terminations, with Reference to Class "B" Modulator Applications.—H. R. Cantelo. (*Marconi Rev.*, April/June 1949, Vol. 12, No. 2, pp. 41–56.) The properties of certain *m*-derived filters terminated by a load of constant resistance are examined at frequencies up to 1.5 times the cut-off frequency. With a preferred configuration of filter, the secondary leakage inductance of the modulation transformer can be included as part of the filter system. Formulae and curves are given for three types of filter. The attenuation and phase shift between input and output of the filter system are also calculated.

621.392.52 : 621.395.44 **1891**

Telephony Filters and the Effect of Termination and Losses on their Characteristics: Parts 1 & 2.—J. F. Schouten. (*Communication News*, April & Aug. 1948, Vol. 9, Nos. 3 & 4, pp. 61–69 & 97–106.) If we assume that all the elements of a reactive network have the same loss-factor, the problem of calculating the effect of these losses on the network can be reduced to that of determining a function of a complex argument when the function is known for an imaginary argument. Three methods of solution are discussed: (*a*) the method of the perpendicular derivative, based on the differential expressions of Cauchy and Riemann, (*b*) representation, based on Laplace's differential equations, of the attenuation and phase of a filter by means of soap-film models, and (*c*) an interpretation, based on Cauchy's integral, analogous to a blurred image in optics.

Within certain limits, a relation exists between the attenuation and phase in a network, as a function of frequency; this relation is ultimately based on the causal relation between the input and output voltage. The soap-film method is applied to several common types of simple filter which can be considered as prototypes of more complex filters.

621.392.52 : 621.396.621 : 621.396.5 **1892**

Application of Crystal Filters in [telegraphy] **Receivers.**—F. Maarleveld. (*Tijdschr. ned. Radiogenoot.*, March 1949, Vol. 14, No. 2, pp. 41–55. Discussion, p. 56. In Dutch, with English summary.) The filters are designed for an i.f. of 100 kc/s and bandwidths of 50, 250, 500 and 1 500 c/s respectively. Design formulae are tabulated. See also 2041 below.

621.395.667 : 621.397.6 **1893**

Phase and Amplitude Equalizer for Television Use.—E. D. Goodale & R. C. Kennedy. (*RCA Rev.*, March 1949, Vol. 10, No. 1, pp. 35–42.) Describes an equalizer of variable frequency response. Two amplifiers having resonant-circuit loads of variable damping and resonance frequency are used for amplitude equalization. To compensate for the phase distortion in the applied signal and for that produced in the amplitude equalizer, amplifiers with variable phase-shift and constant gain are used.

621.396.611.3 **1894**

Oscillator Power Variation and Frequency Pull-In.—L. S. Schwartz. (*Tele-Tech*, Jan. 1949, Vol. 8, No. 1, pp. 30–32, 57.) An analysis of the effect of coupling variation for a mismatched feeder and an oscillator. Curves show how the oscillator power varies with coupling coefficient and s.w.r. Results of measurements using a lighthouse triode and cavity resonator are also included.

621.396.615 **1895**

Frequency Variation of a Crystal-Bridge Oscillator.—W. Herzog. (*Arch. elekt. Übertragung*, Dec. 1948, Vol. 2, No. 9, pp. 357–361.) A simple bridge arrangement in the grid circuit of a valve oscillator enables a considerable variation of the crystal resonance frequency to be achieved. An auxiliary parallel circuit may be used to suppress one of the two possible oscillation frequencies.

621.396.615 **1896**

Variable Frequency R-C Oscillators.—F. Butler. (*Electronic Engng*, April 1949, Vol. 21, No. 254, pp. 140–142.) Discussion of phase-shift types having a frequency-selective network associated with a suitable amplifier. A practical oscillator circuit for the frequency range 250–5 000 c/s is described in detail.

621.396.615 : 621.384.612.1† **1897**

Pulsed Oscillator for F. M. Cyclotron.—J. W. Burkig, E. L. Hubbard & K. R. MacKenzie. (*Rev. sci. Instrum.*, Feb. 1949, Vol. 20, No. 2, p. 135.)

621.396.615 : 621.396.619.13 **1898**

Single-Valve Frequency-Modulated Oscillators: Parts 1 & 2.—K. C. Johnson. (*Wireless World*, April & May 1949, Vol. 55, Nos. 4 & 5, pp. 122–123 & 168–170.) Part 1: A coil in the anode circuit of a pentode, coupled inductively to the cathode circuit, is used to modulate the effective value of the main tuning inductance without disturbing the oscillatory circuit seriously. The amplitude of oscillation can be very nearly constant over frequency ranges at least as great as ±15% and at central frequencies up to 10 Mc/s, since all the effects of circuit capacitance can be tuned out and the valve input capacitance is unimportant.

Part 2: Details of design and operation.

621.396.615.17 **1899**

Theoretical and Experimental Study of a Generator of Periodic Slave-Frequency Electrical Pulses.—R. Legros. (*Rev. gén. Élect.*, April 1949, Vol. 58, No. 4, pp. 143–154.) Two circuits are discussed, of which one is an amplifier-limiter transforming an input voltage of variable waveform, amplitude and frequency into a square-wave voltage of the same frequency, but almost constant waveform and maximum amplitude. The second circuit is a pulse generator operated by this square-wave output and providing pulses of duration short compared with their recurrence period. Amplifier-limiter circuits using (*a*) diodes, (*b*) pentodes as limiters are investigated; neither diodes nor pentodes are entirely satisfactory by themselves, but a combination of the two gives excellent results. Pulses obtained by use of a RC differentiator circuit are shown to be practically independent, as regards peak voltage and pulse shape, of the initial voltage waveform applied to the amplifier-limiter.

621.396.615.17 : 621.317.755 **1900**

A Linear Resistance-Charged Gas Relay Time Base.—E. J. B. Willey. (*Electronic Engng*, March 1949, Vol. 21, No. 253, p. 101.) A circuit designed to avoid the type of transformer ordinarily used, which has one winding very well insulated and also screened to minimize the risk of pickup in the sensitive grid and cathode circuits of the relay. Full component details are given.

621.396.615.17 : 621.317.755 **1901**

A Wide-Range Saw-Tooth Generator.—P. G. Sulzer. (*Rev. sci. Instrum.*, Jan. 1949, Vol. 20, No. 1, pp. 78–80.) Description of a circuit which can be used as a timebase at frequencies between 15 c/s and 500 kc/s, with good linearity and rapid flyback. A cathode-coupled multivibrator is modified by including a parallel RC combination in the cathode lead of the first valve.

621.396.615.17 : 621.385.032.24 **1902**

Grid Current with RC Coupling.—H. T. Ramsay. (*Wireless Engr*, April 1949, Vol. 26, No. 307, pp. 113–118.) A mathematical analysis of the effect of grid current on the performance of a cathode-coupled multivibrator (Schmitt) circuit, to find the optimum values for the components for operation at a given minimum frequency. Experimental results support the theory.

621.396.645 **1903**

High-Frequency Amplifier Stages, with Particularly High Sensitivity and Cut-Off Sharpness, for Short-Wave and Ultra-Short-Wave Apparatus.—H. Rückert. (*Arch. elekt. Übertragung*, Jan. 1949, Vol. 3, No. 1, pp. 24–31.) Discussion with particular reference to input-circuit design, noise factor and the effect of feedback. Results with a circuit of high sensitivity are given and also a few data for some suitable pentodes.

621.396.645 **1904**

10-kW F.M. Broadcast Amplifier.—J. R. Boykin. (*FM-TV*, Dec. 1948, Vol. 8, No. 12, pp. 18–20.) A grounded-grid amplifier, whose anode voltage is only 3 700 V. Two triodes, Type WL3X2500A-3, are used. An apparent efficiency of 100% is achieved in the frequency band 88–108 Mc/s.

621.396.645 : 537.311.33 : 621.315.59 **1905**

Some Novel Circuits for the Three-Terminal Semiconductor Amplifier.—W. M. Webster, E. Eberhard & L. E. Barton. (*RCA Rev.*, March 1949, Vol. 10, No. 1, pp. 5–16.) Equivalent circuits for d.c. and a.c. are proposed for a transistor. The a.c. circuit is a T-network of resistances between base, emitter (positive electrode) and collector (negative electrode) with a generator in series with the collector. The generator has an e.m.f. μ times the voltage developed across the emitter resistance by the emitter current. Three amplifier connections are analysed. The first, already described by Bardeen & Brattain (264 of January) has the base as a common electrode, with input to the emitter and output from the collector. The two new connections, which have input and output impedances more suitable for most purposes, have the input to the base, and output respectively from the emitter and the collector. These connections are applied to a direct-coupled amplifier, a 2-terminal oscillator, a relaxation oscillator and a flip-flop circuit.

621.396.645 : 539.16.08 **1906**

A Simple Counter-Tube Amplifier.—H. Goldstein. (*Z. angew. Phys.*, March 1949, Vol. 1, No. 7, pp. 329–330.) A 2-valve amplifier suitable for operating a counting mechanism is described; its usefulness is limited by relatively low gain. A similar 3-valve circuit has adequate gain for most purposes. Both amplifiers are designed for 200-V anode supply.

621.396.645 : 621.317.733 **1907**

An Amplifier for use with Conductance Bridges.—D. J. G. Ives & R. W. Pittman. (*Trans. Faraday Soc.*, Sept. 1948, Vol. 44, No. 309, pp. 644–646.) Two amplifying channels are used, one being fed with the bridge signal plus the inseparable interference and the other with interference alone, collected by an aerial near the bridge. The outputs are combined to cancel the interference, leaving a clear signal in the final output. Full circuit details are given of an amplifier sensitive to a few microvolts at 1 200–5 000 c/s.

621.396.645 : 621.383 **1908**

The Development of a Photoelectric A.C. Amplifier with A.C. Galvanometer.—J. M. W. Milatz & N. Bloembergen. (*Physica, 's Grav.*, March 1946, Vol. 11, No. 6, pp. 449–464. In English.) An a.c. galvanometer is fed by the same a.c. source as that for a synchronous motor driving a sector disk which interrupts the light falling on a photocell. This device is sensitive only to 50-c/s a.c. of the right phase. Fluctuations due to thermal effects were practically eliminated by cooling the photocell with liquid air.

621.396.645.029.3 **1909**

Compact 6AS7G Amplifier for Residence Audio Systems.—C. G. McProud. (*Audio Engng, N.Y.*, March & April 1949, Vol. 33, Nos. 3 & 4, pp. 17–19, 40 & 16–19.) Circuit and construction details of an amplifier having output power about 6 W, switching for selecting radio or gramophone input, sufficient gain and low-frequency equalization for low-level magnetic pickups, separate high- and low-frequency tone controls, and remote control facilities.

621.396.645.371 **1910**

Negative-Feedback Amplifiers.—C. F. Brockelsby. (*Wireless Engr*, Feb. 1949, Vol. 26, No. 305, pp. 43–49.) When negative feedback is applied to an amplifier with two or more stages, the frequency characteristic develops peaks at the edges of the band if a certain small amount of feedback is exceeded. These peaks get higher and sharper with increasing feedback until self-oscillation begins. The flatness of the frequency characteristic can be improved, without using filters, by properly distributing the gain between the stages of the amplifier. The frequency characteristics of 2- and 3-stage amplifiers are discussed theoretically; results are confirmed experimentally. It is suggested that a 3-stage amplifier should have two identical wide-band stages and one narrow-band stage; this is contrary to the usual practice.

621.396.662 **1911**

Fixed-Frequency F.M. Tuners.—F. A. Spindell. (*FM-TV*, April 1949, Vol. 9, No. 4, pp. 16–17, 32.) A circuit diagram of the basic unit, model RP-23, is given and discussed. Models RP-24 and RP-25 have additional control units for selecting in sequence two preset audio volume levels and for switching on and off. The first half of a 12AX7 is associated with a bridged-T network and acts as a narrow-band amplifier at the control frequency. The second half of the 12AX7 amplifies the signal, which is applied to a 12AU7 operating a sensitive relay. This relay energizes a sequence relay which selects the required audio output level.

621.396.69 : 061.3 **1912**

Developments in Components.—(*Wireless World*, April 1949, Vol. 55, No. 4, pp. 133–138.) Brief details of exhibits at the Radio Component Manufacturers' Federation 1949 exhibition. See also *Overseas Engr*, April 1949, Vol. 22, No. 258, p. 310, and *Electronic Engng*, April 1949, Vol. 21, No. 254, pp. 146–149.

621.396.615.17/.18 + 621.317.35 **1913**

Waveforms. [Book Review]—Chance, Hughes, MacNichol, Sayre & Williams. (*See* 2006.)

GENERAL PHYSICS

535 + 621.396 **1914**

Interference, Diffraction and Spectral Resolution in Optics and Radio.—G. S. Gorelik. (*Uspekhi Fiz. Nauk*, Nov. 1948, No. 3, pp. 407–415. In Russian.) A unified conception of the phenomena common to both sciences.

535.215 : 621.383 **1915**

On Photoelectric Voltages in Light-Absorbing Materials.—A. P. Snoek & C. J. Gorter. (*Physica, 's Grav.*, Feb. 1946, Vol. 11, No. 5, pp. 426–432. In English.)

535.215 : 621.383 **1916**

On the Interpretation of Observations on the Photoelectric Voltages with Intermittent Light.—C. J. Gorter, L. J. F. Broer & A. P. Snoek. (*Physica, 's Grav.*, Feb. 1946, Vol. 11, No. 5, pp. 401–411. In English.)

537.521 **1917**

On the Dielectric Properties of a Gas Discharge.—E. E. Salpeter & R. E. B. Makinson. (*Proc. phys. Soc.*, 1st March 1949, Vol. 62, No. 351B, pp. 180–188.) Formal expressions are derived for the space currents and electrode currents obtained by applying a sinusoidal voltage to a pair of electrodes projecting into a gas discharge.

537.521.7 **1918**

Experimental Investigations of the Electrical and Optical Phenomena in Spark Breakdown in Gases.—E. Fünfer. (*Z. angew. Phys.*, March 1949, Vol. 1, No. 7, pp. 295–304.)

538.122 **1919**

Lines of Magnetic Force Made Visible.—(*Radio Tech., Vienna*, April 1949, Vol. 25, No. 4, pp. 259–260.) A special gas-filled diode, when brought near the poles of a magnet, shows the lines of force as luminous streaks. The electrons inside the tube travel along a narrow path coincident with a tube of force and ionize the gas in the tube. The field can be plotted by moving the tube to different positions relative to the magnet poles. A tube with 8 anodes, giving 8 narrow electron beams, is described.

538.56 : 535.13 : 621.396.67 **1920**

The Radiation and Transmission Properties of a Pair of Semi-Infinite Parallel Plates : Part 1.—A. E. Heins. (*Quart. appl. Math.*, July 1948, Vol. 6, No. 2, pp. 157–166.) A plane monochromatic e.m. wave is incident upon the plates, which are assumed thin and perfectly conducting. The amplitude and phase of the wave travelling between the plates are calculated. The structure is regarded as a two-dimensional receiving aerial and its radiation pattern is obtained. Its properties as a transmitting aerial will be considered later. See also 2756 and 3504 of 1947 (Carlson & Heins).

538.569.4 : 546.331.31-145.1 **1921**

Absorption of Ultra High Frequency Waves in Salt Solutions.—S. K. Chatterjee & B. V. Sreekantan. (*Indian J. Phys.*, Dec. 1948, Vol. 22, No. 12, pp. 547–552.) For aqueous solutions of $MgCl_2$, $CuSO_4$ and KCl, the absorption maxima in the range 300–500 Mc/s shift towards higher concentration for higher frequencies. See also 3099 of 1948.

53/54 **1922**

Table of Physical and Chemical Constants. [Book Review]—G. W. C. Kaye & T. H. Laby. Longmans, Green & Co., London, 10th edn 1948, 194 pp., 21s. (*Proc. phys. Soc.*, 1st March 1949, Vol. 62, No. 351B, p. 209.) Considerable revision has been undertaken; the fundamental constants have been corrected in the light of recent determinations, and derived constants re-calculated.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.745 : 550.385 **1923**

Magnetic Storms and Solar Activity, 1948.—H. W. Newton. (*Observatory*, Feb. 1949, Vol. 69, No. 848, pp. 38–40.) Provisional sunspot numbers, magnetic storms and sudden commencements are tabulated and discussed.

523.746 : 550.38 **1924**

Observational Aspects of the Sunspot-Geomagnetic Storm Relationships.—H. W. Newton. (*Mon. Not. R. astr. Soc. geophys. Supplement*, March 1949, Vol. 5, No. 8, pp. 321–335.) Full paper, summary abstracted in 1370 of May.

538.12 : 521.15 **1925**

The Magnetic Field of Massive Rotating Bodies.—P. M. S. Blackett. (*Phil. Mag.*, Feb. 1949, Vol. 40, No. 301, pp. 125–150.) Continuation and elaboration of 3112 of 1947.

550.38 "1947.10/.12" **1926**

Cheltenham [Maryland] ***K*-Indices for October to December, 1947.**—In 379 of February the author's initials should be R.E.

550.384.4 : 551.510.535 **1927**

Daily Magnetic Variations near the Equators.—D. F. Martyn. (*Nature, Lond.*, 30th April 1949, Vol. 163, No. 4148, pp. 685–686.) The observed anomalies appear to require the existence in the ionosphere of a region of high electric conductivity, about 15° of latitude wide, encircling the world approximately midway between the magnetic equator (line of zero inclination) and the geomagnetic equator (equidistant from the magnetic poles). See also 1936 and 2790 of 1948 (Egedal) and 710 of March (Chapman).

551.510.52 **1928**

The Structure of the Temperature Field in a Turbulent Stream.—A. M. Obukhov. (*Bull. Acad. Sci. U.R.S.S., sér. géogr. géophys.*, 1949, Vol. 13, No. 1, pp. 58–69. In Russian.) Results obtained are mentioned in 2024 below.

551.510.535 **1929**

On the Connections between an Oxygen-Atom Zone, Ionized Layers and Radiation due to the Mögel-Dellinger Effect.—E. Schröer. (*Z. Met.*, Jan./Feb. 1947, Vol. 1, Nos. 4/5, pp. 110–113.) Calculations based on the most probable values of dissociation and recombination coefficients indicate that the oxygen-atom zone extends upwards from a height of about 100 km. Recombination takes place so slowly that the zone persists through the night. The F layer may be due to photoionization of the N_2 molecule. Radiation in the band 661–765 Å could produce the E layer by photoionization of O_2; radiation in the band 910–1 010 Å could, similarly, produce a layer at a height of 60–100 km with ion concentration normally insufficient for the reflection of e.m. waves.

551.510.535 **1930**

Ionospheric Disturbances and their Terrestrial Effects.—G. Leithäuser. (*Funk u. Ton*, March 1949, Vol. 3, No. 3, pp. 127–143.) A general discussion, with particular reference to observations in Germany of ionosphere layer heights, aurora and sporadic-E, and correlation with propagation phenomena and geomagnetic effects.

551.510.535 : 523.3 : 621.396.11 **1931**

Moon Echoes and Penetration of the Ionosphere.—Kerr, Shain & Higgins. (*See* 2030.)

551.510.535 : 551.557 **1932**

Atmospheric Currents at a Height of 120 km.—C. Hoffmeister. (*Z. Met.*, Nov./Dec. 1946, Vol. 1, Nos. 2/3, pp. 33–41.) Observations extending from 1922 to 1945 are tabulated and discussed. At heights above 100 km in latitude 50°N, currents are observed in summer from SSW/SW with stable velocities of about 50 m/s and relatively little dispersion in either direction or velocity. In winter two current systems are found, one identical with that of summer but deviated slightly westwards, the other consisting of polar-air currents from NW/NE. Velocities are higher in winter than in summer, with mean values of 65 m/s for the SW currents and 89 m/s for the northerly. The dispersion in the observed values of direction and velocity is much greater in winter than in summer. 21% of the observed velocities exceeded 100 m/s; velocities above 200 m/s were seldom noted; the highest value was 267 m/s. Possible explanations of the effects are suggested.

551.510.535 : 621.317.79 **1933**

Sweep Frequency Ionosphere Equipment.—Sulzer. (*See* 2004.)

551.510.535 : 621.396.11 **1934**

The Ionosphere over Mid-Germany in February 1949.—Dieminger. (*Fernmeldetech. Z.*, March 1949, Vol. 2, No. 3, p. 94.) Mean values of the limiting frequencies and heights of the E and F layers, deduced from measurements at Lindau über Northeim, are plotted and discussed. From 12th to 21st February the limiting frequency of the F_2 layer was unexpectedly high and on three occasions about midday exceeded 14 Mc/s.

551.510.535 : [621.396.61 + 621.396.621 **1935**

Ionosphere Sounding [equipment].—Maguer. (*See* 2069.)

551.593.9 **1936**

The Luminescence of the Atmosphere.—I. A. Khvostikov. (*Uspekhi Fiz. Nauk*, Nov. 1948, No. 3, pp. 372–386. In Russian.)

LOCATION AND AIDS TO NAVIGATION

621.396.9 : 523.3 **1937**

Detection of Radio Signals Reflected from the Moon.—J. H. DeWitt, Jr, & E. K. Stodola. (*Proc. Inst. Radio Engrs, W. & E.*, March 1949, Vol. 37, No. 3, pp. 229–242.) The moon is considered as a radar target and formulae are obtained for the attenuation between transmitter and receiver aerials. An experimental equipment and measuring techniques used for obtaining reflections from the moon are described and results obtained are given. The possibility of using signals reflected from the moon for communication purposes is considered. See also 2915 of 1948 (Grieg, Metzger & Waer).

621.396.93 **1938**

V.H.F. Automatic Direction Finder.—(*Engineer, Lond.*, 18th Feb. 1949, Vol. 187, No. 4856, p. 197.) A short account of the remotely operated installation at Brussels airport. Probable error should be 1 degree or less, with a range of 100 nautical miles to aircraft at 10 000 ft. The development of such equipment was fully discussed by Cleaver (1078 of April).

621.396.93 : 519.271 **1939**

Theory of Error Distribution: Application to Radio Navigational Aids.—P. F. Duncan. (*Wireless Engr*, Feb. 1949, Vol. 26, No. 305, pp. 49–52.)

621.396.93.029.62 **1940**

Development of Single-Receiver Automatic Adcock Direction-Finders for Use in the Frequency Band 100-150 Megacycles per Second.—R. F. Cleaver. (*Elect. Commun.*, Dec. 1948, Vol. 25, No. 4, pp. 337–362.) Reprint, with minor additions, of 1078 of April.

621.396.93.088 **1941**

H.F. Transmitter for D.F. Measurements.—B. G. Pressey. (*Wireless Engr*, April 1949, Vol. 26, No. 307, pp. 124–128.) Discussion of the principles of design and the details of construction and operation of an elevated screened-loop transmitter. The loop can be rotated about a horizontal axis to produce a wave of known polarization for the measurement of the polarization error of d.f. systems. The parallax error that occurs if a dipole is used as the radiator is thus eliminated.

621.396.932 : 621.396.9 **1942**

The Development of Shipborne Navigational Radar.—R. F. Hansford. (*J. Inst. Nav.*, April 1948, Vol. 1, No. 2, pp. 118–141. Discussion, pp. 141–147.) Survey based on two papers presented at the International Meeting whose report was noted in 3135 of 1947. Some of the navigational data has been elaborated and the account has been brought up to date; possible future developments are discussed.

621.396.933 **1943**

Note on a Short-Range Radio Position-Finding System Using Modulated Continuous Waves.—R. F. Cleaver. (*Elect. Commun.*, Dec. 1948, Vol. 25, No. 4, pp. 363–372.) Reprint, with minor additions, of 96 of January.

621.396.933.2 **1944**

Radio Distance-Measuring Equipment for Aerial Navigation.—(*Engineering, Lond.*, 25th Feb. 1949, Vol. 167, No. 4335, p. 187.) Long summary of paper abstracted in 1402 of May (Busignies).

621.396.933.2 : 621.396.826 : 621.396.619.16 **1945**

Elimination of Reflected Signal Effects in Pulsed Systems.—D. O. Collup. (*Tele-Tech*, Jan. 1949, Vol. 8, No. 1, pp. 38–40..64.) Multipath reflections can increase the apparent width of the shorter radar pulses in systems which depend on pulse width or pulse spacing to convey information. The incoming direct pulse can, however, be used to make the receiver insensitive to pulses whose amplitude is not constant over the whole pulse width. An echo-suppression circuit of this type for a radar transponder beacon is described.

621.396.933.24 **1946**

Rotating Field Beacons.—F. de Fremery. (*Communication News*, Sept. 1947, Vol. 9, No. 1, pp. 2–20.) Beacons rotated mechanically cannot provide information quickly enough for aerial navigation. This difficulty can be overcome by rotating the field electrically and comparing its phase with that of a pulsating field, but the two fields must not have the same frequency, as they could not then be separated in the receiver. The properties of simple and modulated rotating fields are discussed. If two fields have harmonically related frequencies, the phase angle between them can be measured accurately with simple apparatus at the receiver, and this phase angle is a multiple of the azimuth. A rough bearing is obtained from modulation with fields of frequencies f_0 and $2f_0$ rotating in the same sense; the accurate bearing, which by itself would be ambiguous, is obtained from modulation of fields of frequencies f_0 and nf_0 rotating in opposite senses. Apparatus for transmitting and receiving such fields is described.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788 **1947**

Construction and Theoretical Analysis of a Direct-Reading Hot-Wire Vacuum Gauge with Zero Point Control.—J. A. H. Kersten & H. Brinkman. (*Appl. sci. Res.*, 1949, Vol. A1, No. 4, pp. 289–305.) Description of a gauge connected to a special bridge, unaffected by voltage fluctuations or changes in ambient temperature. Pressures between 10^{-5} and 10^{-1} mm Hg can be measured.

531.788.7 **1943**

Design of an Ionization Manometer Tube.—D. L. Hollway. (*Elect. Commun.*, Dec. 1948, Vol. 25, No. 4, pp. 373–385.) An abridged version was abstracted in 3916 of 1947.

535.37 **1949**

Luminescent Solids (Phosphors).—H. W. Leverenz. (*Science*, 25th Feb. 1949, Vol. 109, No. 2826, pp. 183–195.) A general discussion of the properties of typical phosphors, luminescence mechanism and luminescence emission spectra.

535.37 : 535.61-15 **1950**

Inertia Effects in Infra-Red Sensitive Phosphors.—F. R. Scott, R. H. Thompson & R. T. Ellickson. (*J. opt. Soc. Amer.*, Jan. 1949, Vol. 39, No. 1, pp. 64–67.) Discussion of results of measurements of the time required for certain phosphors to acquire maximum brightness when exposed to infra-red radiation.

535.37 : 621.315.61.011.5 **1951**

The Optical and Electrical Properties of Zinc Silicate Phosphors.—E. Nagy. (*J. opt. Soc. Amer.*, Jan. 1949, Vol. 39, No. 1, pp. 42–49.) A close connection was found between dielectric loss and luminescence. See also 1051 of 1948 (Szigeti & Nagy).

537.311.33 **1952**

Electron Diffraction and Rectification from Silicon and Pyrite Surfaces.—J. M. Cowley & J. L. Symonds. (*Trans. Faraday Soc.*, Jan./Feb. 1948, Vol. 44, No. 302, pp. 53–60.) For the best rectification, the crystal lattice should be almost perfect and free from fracture or mosaic structure.

538.213 **1953**

Permeability Decrease with Increasing Frequency.—H. J. van Leeuwen. (*Physica, 's Grav.*, Jan. 1944, Vol. 11, No. 1, pp. 35–42. In Dutch, with French summary.) Theoretical discussion.

538.221 **1954**

The Magnetic Structure of High-Conductivity Alloys: Part 1 — On Certain Peculiarities of the Magnetization Curves and Hysteresis Loops of Alnico and Vicalloy.—L. A. Shubina & Ya. S. Shur. (*Zh. tekh. Fiz.*, Jan. 1949, Vol. 19, No. 1, pp. 88–94. In Russian.) Part 2, 1955 below.

538.221 **1955**

The Magnetic Structure of High-Conductivity Alloys: Part 2 — The Effect of Thermal Treatment on the Electrical Resistance of Alnico.—V. I. Drozhzhina, M. G. Luzhinskaya & Ya. S. Shur. (*Zh. tekh. Fiz.*, Jan. 1949, Vol. 19, No. 1, pp. 95–99. In Russian.) Part 1, 1954 above.

538.221 **1956**

The Structure and Properties of the Alloy Cu_2MnIn.—B. R. Coles, W. Hume-Rothery & H. P. Myers. (*Proc. roy. Soc. A*, 22nd Feb. 1949, Vol. 196, No. 1044, pp. 125–133.)

538.221 : 621.317.4.029.62 **1957**

Ferromagnetism at Very High Frequencies: Part 2 — Method of Measurement and Processes of Magnetization.—Johnson & Rado. (*See* 1994.)

538.221 : 621.318.22 : 538.652 **1958**

The Cause of Anisotropy in Permanent Magnet Alloys.—K. Hoselitz & M. McCaig. (*Proc. phys. Soc.*, 1st March 1949, Vol. 62, No. 351B, pp. 163–170.) Magnetostriction measurements on samples of Alcomax II indicate that, in the absence of a field, the domain magnetization is along the easy crystallographic direction which makes the smallest angle with the axis of anisotropy.

539.23 : 537.311 **1959**

Measurements of the Electrical Resistance of Thin Films of Copper, Silver and Lead.—A. van Itterbeek & L. de Greve. (*Physica, 's Grav.*, Feb. 1944, Vol. 11, No. 2, pp 78–90. In French.) Results are presented for films of thickness up to 100 $m\mu$ from room temperature down to the boiling point of liquid hydrogen. The temperature coefficient of resistance for Cu and Ag films is much less than that of the ordinary metal and becomes negative for a thickness of 3 $m\mu$ Cu or 4.5 $m\mu$ Ag.

539.23 : 537.311 **1960**

Measurements of the Electrical Resistance of Superposed Metallic Films.—A. van Itterbeek & L. de Greve. (*Physica, 's Grav.*, March 1946, Vol. 11, No. 6, pp. 465–469. In French, with English summary.) The resistance of Ag/Cu or Cu/Ag films agrees fairly well with that calculated for resistances in parallel, except when the film first deposited is extremely thin.

539.23 : 537.311 : 546.74 **1961**

Some Measurements on Thin Films of Nickel.—A. van Itterbeek & L. de Greve. (*Physica, 's Grav.*, March 1946, Vol. 11, No. 6, pp. 470–474. In French, with English summary.) For the principal results see 343 and 3305 of 1946.

546.281.26 **1962**

On the Causes of the Nonlinearity of the Volt-Ampere Characteristic of Carborundum.—V. I. Pruzhinina-Granovskaya. (*Zh. tekh. Fiz.*, Jan. 1949, Vol. 19, No. 1, pp. 100–110. In Russian.)

546.431.82 **1963**

The Dielectric Behaviour of $BaTiO_3$ Single-Domain Crystals.—W. J. Merz. (*Phys. Rev.*, 15th Feb. 1949, Vol. 75, No. 4, p. 687.)

549.514.51 **1964**

Production of Large Artificial Quartz Crystals.—I. Franke & M. H. de Longchamp. (*C. R. Acad. Sci., Paris*, 28th March 1949, Vol. 228, No. 13, pp. 1136–1137.) An autoclave process is described briefly. A seed crystal is arranged in a cool part and quartz or fused silica in the hottest part of the alkaline solution in the vessel, the pressure in which is maintained at 60 atmospheres and the temperature at 200°–300°C. Homogeneous crystals 3 × 2 × 0.5 cm, with good electrical properties, are produced in 3–4 weeks.

549.514.51 : 534.133 **1965**

Notes on the Frequency-Temperature Relationship of Some Low-Frequency Quartz Plates.—D. Fairweather & N. J. Beane. (*Marconi Rev.*, April/June 1949, Vol. 12, No. 2, pp. 68–80.) Longitudinal oscillations are mainly considered; various types of cut are discussed. Flexural types of vibration are likely to increase in importance but more information is required. The Bell Telephone Laboratory terminology for angles of cut (see 1995 of 1944) is used. The constants controlling the form of the frequency/temperature curves are derived by a method closely related to that of Mason (3518 of 1940). Design data are deduced from these and similar curves, and the relationships encountered in practice are discussed.

620.197 **1966**

The Climatization of Radio Equipment.—M.A. (*Radio tech. Dig., Édn franç.*, April 1949, Vol. 3, No. 2, pp. 115–120.) A note reviewing modern methods of protection against extremes of temperature, humidity, fungi and insects, together with a list of 70 recent references.

620.197 : 621.319.45 **1967**

On the Climatization of the Electrolytic Capacitor.—H. E. Miquelis. (*Radio tech. Dig., Édn franç.*, April 1949, Vol. 3, No. 2, pp. 77–82.) A few details are given concerning capacitors of several types; one type can withstand temperatures from −60° to + 90°C in store or during transit and functions satisfactorily in the range from −40° to + 70°C.

621.315.59 : 537.311.33 : 621.396.645 **1968**

Germanium — Important New Semiconductor.—W. C. Dunlap, Jr. (*Gen. elect. Rev.*, Feb. 1949, Vol. 52, No. 2, pp. 9–17.) An account of the chemical, physical and electrical properties of Ge, and its application in the transistor.

621.315.59 : 621.319.4 **1969**

On the Use of Semiconducting Liquids for Impregnating Paper Capacitors.—V. T. Renne. (*Zh. tekh. Fiz.*, Feb. 1949, Vol. 19, No. 2, pp. 218–224. In Russian.)

621.315.61.011.5 : 546.431.82 **1970**

Anomalous Dielectric Properties of Polycrystalline Titanates of the Perovskite Type.—J. R. Partington, G. V. Planer & I. I. Boswell. (*Phil. Mag.*, Feb. 1949, Vol. 40, No. 301, pp. 157–175.)

621.315.612.011.5 **1971**

A New Type of Dielectric Polarization, and Losses in Polycrystalline Dielectrics.—G. I. Skanavi & A. I. Demeshina. (*Zh. eksp. teor. Fiz.*, Jan. 1949, Vol. 19, No. 1, pp. 3–17. In Russian.) Experiments were conducted with materials having a distorted crystal lattice. The materials were obtained by sintering TiO_2 with oxides of the second group of metals. Materials with small additions of SrO, CaO, BaO and ZnO have a high dielectric constant (of the order of 1 000) at frequencies from 10 to 20 kc/s. The loss angle is greater than for pure TiO_2, and has pronounced frequency and temperature maxima. Variations of ϵ and $\tan \delta$ with increase of concentration of the alkaline earths are shown graphically. The experimental results are in agreement with a theory of relaxation polarization developed in earlier papers. The activation energy of loosely coupled ions and the frequency of their oscillations, as calculated from the experimental data, have abnormally low values.

621.315.618.015.5 : 537.52 **1972**

Breakdown Voltage of Rare-Gas/Nitrogen Mixtures between Hot Electrodes.—J. A. M. van Liempt & W. D. van Wijk. (*Physica, 's Grav.*, March 1944, Vol. 11, No. 3, pp. 167–178. In German.) The dependence of the breakdown voltage on the nitrogen content, the gas pressure and the temperature and separation of the electrodes is shown graphically. The results are discussed with reference to the design of gas-filled glow lamps.

621.775.7 **1973**

Powder Metallurgy.—G. FitzGerald-Lee. (*Electronic Engng*, March 1949, Vol. 21, No. 253, pp. 87–90.) The development of the art is outlined and basic principles are briefly discussed. Methods of controlling grain growth are considered with particular reference to the production of tungsten wire with properties suitable for lamp filaments. Various applications are mentioned.

666.1.037.5 **1974**

The Technique of Glass-to-Metal Sealing with Special Reference to Vacuum-Tight Seals.—A. G. Long. (*J. Soc. Glass Tech.*, 1946, Vol. 30, No. 137, pp. 67–89.) A general survey ranging from wire seals used in valve pinches to cylindrical seals some 4 in. in diameter, from the standpoint of the author's personal experience. Practical manufacturing details are discussed and illustrated.

666.1.037.5 : 621.385.032.5 **1975**

The Electrode Leads of Transmitting Valves.—E. G. Dorgelo. (*Communication News*, Dec. 1947, Vol. 9, No. 2, pp. 38–44.) Survey and discussion of various methods of sealing.

MATHEMATICS

517.53 : 621.392.52 **1976**

Splitting of an Analytical Function into an Even and an Odd Component, and also a Method of Determining, for a Known Even Component, the Odd Component and the Function as a Whole.—Correction to 1422 of May, the title of which should read as above.

518.5 **1977**

Multiplication and Division by Electronic-Analogue Methods.—E. M. Deeley & D. M. MacKay. (*Nature, Lond.*, 23rd April 1949, Vol. 163, No. 4147, p. 650.) A multiplier should have (*a*) symmetry of response to positive and negative inputs, (*b*) an absolute indication of zero input, (*c*) independence of normal changes in electronic characteristics, and (*d*) rapid and accurate response. A multiplier having a c.r.o. with an axial magnetic field is here described ; the transverse velocity of the electron stream is proportional to the voltage V_x applied to the X-plates of the c.r.o. The magnetic field H produces a deflecting force initially in the Y-direction, proportional to HV_x. This is counteracted by a photoelectric feedback system ; the spot can thus be held close to the X axis, and the voltage V_y is then proportional to the product of V_x and the current i_H producing the field H. Conversely, the photocell can be used to control H so that i_H is proportional to V_y/V_x. Preliminary experimental results with this technique are satisfactory.

518.5 : 512.25 **1978**

A Twelve-Equation Computing Instrument.—C. E. Berry & J. C. Pemberton. (*Instruments*, July 1946, Vol. 19, No. 7, pp. 396–398.) An instrument of the decade-potentiometer type for solving linear simultaneous equations by successive approximation.

518.5 : 517.944 **1979**

A Note on Analog Computer Design.—J. A. Bronzo & H. G. Cohen. (*Rev. sci. Instrum.*, Feb. 1949, Vol. 20, No. 2, pp. 101–102.) In certain types of partial differential equations, the spatial derivatives may be replaced by finite difference expressions. By using Laplace transforms and matrices, the original equations can be re-formulated as a set of linear simultaneous equations. A simpler procedure sometimes results from the application of a ' similarity transformation ' to the matrix of these equations before designing a computer to solve them.

517.564.3(083.5) **1980**

Tables of Bessel Functions of Fractional Order. Vol. 1. [Book Review]—National Bureau of Standards. Columbia University Press, 1st edn 1948, 418 pp. (*Phil. Mag.*, Jan. 1949, Vol. 40, No. 300, p. 124.) $J_\nu(x)$ is tabulated to 10 places of decimals for $\pm\nu = \frac{1}{4}, \frac{1}{3}, \frac{2}{3}$, and $\frac{3}{4}$, and $x = 0(0.001)0.9(0.01)25.0$. Auxiliary tables are provided to extend the range to values of x up to 30 000.

518.2 **1981**

Practical Five-Figure Mathematical Tables. [Book Review]—C. Attwood. Macmillan, London, 1948, 74 pp., 3s. (*Wireless Engr*, Aug. 1948, Vol. 25, No. 299, p.267 ; *Nature, Lond.*, 26th Feb. 1949, Vol. 163, No. 4139, p.306.) The problem of the regions where mean proportional parts are untrustworthy has been resolutely tackled by adjusting the interval of tabulation to suit the rate of change of the function tabulated. " The book . . . can be thoroughly recommended."

MEASUREMENTS AND TEST GEAR

531.761 + 621.3.018.4(083.74) **1982**

Standard Frequency Broadcasts from Hawaii.—(*Tech. Bull. nat. Bur. Stand.*, March 1949, Vol. 33, No. 3, pp. 39–40.) An experimental station on the island of Maui, Territory of Hawaii, now broadcasts standard frequencies (5, 10 and 15 Mc/s), time announcements, standard time intervals and standard musical pitch (440 c/s) with call sign WWVH. Simultaneous reception of WWV and WWVH in certain areas should not cause interference.

531.761 + 621.3.018.4(083.74) **1983**

The Atomic Clock.—(*Tech. Bull. nat. Bur. Stand.*, Feb. 1949, Vol. 33, No. 2, pp. 17–24.) The operation depends upon the constant natural frequency associated with the vibrations of atoms in the NH_3 molecule. Accuracy is within 1 part in 10^7; theoretical considerations indicate a potential accuracy within 1 part in 10^9 or 10^{10}, according to the type of atomic system and spectrum line used. The clock consists essentially of a 100-kc/s crystal oscillator, a frequency multiplier, a frequency discriminator, a frequency divider, a special 50-c/s clock and a waveguide absorption cell containing NH_3 at a pressure of 10–15 μ Hg. The fundamental frequency of the oscillator is first multiplied up to 270 Mc/s by means of standard l.f. valves. It is then multiplied up to 2 970 Mc/s by means of a frequency-multiplying klystron, which is also modulated by a f.m. oscillator generating a signal at 13.8±0.12 Mc/s. The f.m. output is multiplied in a Si-crystal rectifier to 23 870.4 ± 0.96 Mc/s and fed to the ammonia absorption cell. As the frequency of this modulated control signal sweeps across the absorption-line frequency (23 870.1 Mc/s) of the NH_3 vapour, the signal reaching the Si rectifier dips because of the absorption, giving a negative output pulse. The output of the f.m. oscillator at 13.8 ± 0.12 Mc/s is also fed to a receiver together with a 12.5-Mc/s signal from the quartz-crystal multiplying chain. When the signal sweeps across the proper frequency (12.5 Mc/s + the 1.39 Mc/s i.f. of the receiver) a second output pulse is generated. If the time interval between these two pulses is incorrect, a control signal is generated in a discriminator circuit and fed to a reactance valve which forces the quartz-crystal circuit to oscillate at the correct frequency. See also *Radio-Electronics*, March 1949, Vol. 20, No. 6, pp. 74–76.

621.317.2 : 621.397.6 **1984**

TV Distribution System for Laboratory Use.—J. Fisher. (*Communications*, Feb. 1949, Vol. 29, No. 2, pp. 8–9 . . 43.) Description of a centralized system for producing the standard R.M.A. composite video signal and distributing it to a number of laboratories with minimum distortion. Sources of signal include (*a*) local television broadcasting stations, (*b*) monoscope signal, and (*c*) picture signal from a c.r. tube flying-spot scanner.

621.317.3 + 621.317.7] : 061.3 **1985**

Papers Digested for Conference on High-Frequency Measurements.—(*Elect. Engng, N.Y.*, March 1949, Vol. 68, No. 3, pp. 251–257.) Authors' summaries of most of the papers read at the conference.

621.317.3 : 621.395.44 **1986**

Maintenance Measurements on Carrier Telephony Equipment.—J. de Jong. (*Philips tech. Rev.*, Aug. 1946, Vol. 8, No. 8, pp. 249–256.) Discussion of apparatus used and operational requirements.

621.317.324† : 621.318.4 **1987**

Coils as H.F. Measurement Probes for Absolute Field-Strength Determinations.—E. Roeschen. (*Funk u. Ton*, March 1949, Vol. 3, No. 3, pp. 167–172.) Measurements with 5 different types of coil indicate that a small single-layer cylindrical coil is particularly suitable for such absolute measurements, since its effective area can be determined accurately from its mean geometrical diameter.

621.317.329 : 538.122 **1988**

[Electrolyte] **Tank Model for Magnetic Problems of Axial Symmetry.**—R. E. Peierls & T. H. R. Skyrme. (*Phil. Mag.*, March 1949, Vol. 40, No. 302, pp. 269–273.) Magnetic problems often involve vortices and cannot therefore be directly represented in the electrolyte tank. For 2-dimensional problems, the conjugate field can be studied; this technique is here applied to systems which are very nearly plane and have axial symmetry.

621.317.335.3† + 621.317.374 **1989**

An Optical Method for Measuring the Dielectric Constant and Dielectric Losses of Solid Dielectrics in the Centimetre Wavelength Range.—L. L. Odynets. (*Zh. tekh. Fiz.*, Jan. 1949, Vol. 19, No. 1, pp. 120–125. In Russian.) Theoretical discussion of a method based on measurements of the transparency of a slab of the dielectric, with a description of the apparatus (Fig.1) used for measuring the transparency of glass and ebonite for $\lambda = 5.5$ cm. The method would be even more suitable for shorter wavelengths since the required overall dimensions of the measuring apparatus would be smaller; liquid dielectrics could also be used.

621.317.34 : 621.315.1/.2 **1990**

No-Load and Short-Circuit Measurements for determining the Transmission Characteristics of Open Lines and Cables.—O. Naumann. (*Arch. tech. Messen*, March 1949, No. 160, pp. T22–T23.) The approximate methods used for calculating the l.f. transmission characteristics of cables from no-load and short-circuit measurements of voltage, current and power are not applicable at h.f. More accurate methods given by Kaden (1063 of 1937), by Sommer for very low frequencies (4070 of 1939), and by Goldschmidt for h.f. (1724 of 1943) are discussed.

621.317.353 : 621.396.619.13 **1991**

The Determination of the Distortion in a Frequency-Modulator.—F. L. H. M. Stumpers & W. W. Boelens. (*Communication News*, Aug. 1948, Vol. 9, No. 4, pp. 107–109.) As the modulation voltage is increased, the amplitudes of the components of the output frequency spectrum vary and pass through the value zero. The zero points can be used for measuring frequency deviation. The displacement of the zeros, caused by non-linearity of the modulation characteristic, can be used for the measurement of odd harmonics. A shift in frequency of the output spectrum as a whole can be used to measure even harmonics.

621.317.372 **1992**

Improved Accuracy with a "*Q*"-Meter by the Use of Auxiliary Components.—A. C. Lynch. (*Electronic Engng*, March 1949, Vol. 21, No. 253, pp. 91–93.) Accuracy can be considerably increased by using a mirror galvanometer in parallel with the meter giving *Q* values, a second galvanometer, suitably shunted, in series with the meter measuring the resonant-circuit response and a variable capacitor with a fine scale of high calibration accuracy in parallel with the fitted tuning capacitor. The principle used is that of the reactance-variation method described by Hartshorn & Ward (351 of 1937), but here the input voltage is varied in known ratios, and the voltage in the circuit is brought to a fixed value by detuning. A circuit diagram is given. A *Q*-meter using this principle is described; accuracy is discussed, and possible methods of further improvement are suggested.

621.317.39.029.6 : 536.33 **1993**

Conditions for Maximum Sensitivity of U.H.F. Radiometers.—J. L. Steinberg. (*Onde élect.*, April 1949, Vol. 29, No. 265, pp. 160–166.) Discussion of apparatus of the type described by Dicke (475 of 1947). With optimum noise factor and input circuit, and a certain amount of negative feedback, it is possible to measure the apparent temperature of a receiving aerial to within about 0.3°C. Apparatus designed for investigation of 1 200-Mc/s radiation, constructed at the physical laboratory of the École Normale Supérieure, uses a dipole-fed parabolic reflector 3 m in diameter mounted on an equatorial support. The superheterodyne receiver has a bandwidth of 20 Mc/s and a noise factor of 3.5. Further details of this equipment will be published later.

621.317.4.029.62 : 538.221 **1994**

Ferromagnetism at Very High Frequencies : Part 2—Method of Measurement and Processes of Magnetization.—M. H. Johnson & G. T. Rado. (*Phys. Rev.*, 1st March 1949, Vol. 75, No. 5. pp. 841–864.) Part 1 : 3182 of 1947 (Johnson, Rado & Maloof).

621.317.7.029.63/.64 (083.74) **1995**

Microwave Measurement Standards.—(*J. Franklin Inst.*, Feb. 1949, Vol. 247, No. 2, pp. 156–161.) Discussion of standards and calibration services available or methods being developed at the National Bureau of Standards for frequencies from 300 Mc/s to over 100 000 Mc/s. These include : (*a*) a frequency standard for 300–40 000 Mc/s accurate within 1 part in 10^8, (*b*) methods and equipment for dielectric measurements at frequencies near 1 000, 3 000, 9 000 and 24 000 Mc/s, (*c*) a primary standard of attenuation consisting of a waveguide operating at a frequency below cut-off, which can be used for any microwave frequency by means of a development of the i.f. substitution method, (*d*) a microwave power-measuring console nearly completed, (*e*) investigation of the accuracy of bolometers and thermal noise sources as power standards, (*f*) development of primary and secondary frequency standards using spectrum lines of gases, (*g*) a prototype atomic clock (see also 1983 above), and (*h*) measurement of spectrum lines as secondary frequency standards.

621.317.71/.72 **1996**

An Instrument for the Measurement and Time Integration of Small Voltages and Currents.—I. A. D. Lewis & A. C. Clark. (*J. sci. Instrum.*, March 1949, Vol. 26, No. 3, pp. 80–84.) Description with full component details. Potentials varying between 0 and 0.5 V and their time integrals can be measured within 3%. Currents can be measured with similar accuracy; full-scale deflection on the lowest range is 0.01 μA.

621.317.71 : 621.385 **1997**

Reduction of Noise in Thermionic Electrometers with Mechanical Conversion.—H. den Hartog & F. A. Muller. (*Physica, 's Grav.*, March 1944, Vol. 11, No. 3, pp. 161–166. In Dutch, with English summary.) Continuation of 858 of 1945.

621.317.715.004.64 : 538.22 **1998**

Non-Ferrous Copper Wire for Moving-Coil Meters.—P. G. Moerel & A. Rademakers. (*Philips tech. Rev.*, Oct. 1946, Vol. 8, No. 10, pp. 315–319.) Effects due to Fe impurity in the Cu wire of the coils is discussed and methods of producing wire with extremely low Fe content are described.

621.317.738 **1999**

A Note on the Measurement of Four-Terminal Inductances by Astbury's Method.—L. H. Ford. (*J. sci.*

Instrum., March 1949, Vol. 26, No. 3, pp. 108–109.) Astbury's method (noted in 1932 Abstracts, p. 48) is unsuitable in its original form for frequencies above a.f., but if the fixed resistance ratio arms of the bridge are replaced by a Kelvin-Varley potential divider of known phase defect, the method can be used for frequencies up to 100 kc/s. Experimental results on a 10-μH coil show good agreement at all frequencies from 1 to 100 kc/s with values obtained by other methods.

621.317.755 **2000**

A 3-Beam Micro-Oscillograph for Display of Oscillations up to 10 000 Mc/s.—v. Fe. (*Frequenz*, Jan. 1949, Vol. 3, No. 1, pp. 19–22.) A short description of Lee's instrument (1692 of 1946) with a tabular comparison with the Rogowski, Siemens and A.E.G. oscillographs.

621.317.761 **2001**

Heterodyne Frequency Meter for High Frequencies.—L. Liot. (*Radio franç.*, April 1949, No. 4, pp. 14–17.) Description, with circuit details, of an instrument for the rapid measurement of frequencies from 5 Mc/s to 1 000 Mc/s. The local oscillator, which is of the Lecher-line type and uses a Type 955 triode, has a frequency range of 69–220 Mc/s; within this range unknown frequencies are measured by a direct zero-beat method, while harmonic methods are used outside the range.

621.317.772.029.54/.58 : 621.396.645.37 **2002**

A Phase Meter for the Frequency Band 100 kc/s–20 Mc/s.—W. T. Duerdoth. (*P.O. elect. Engrs' J.*, April 1949, Vol. 42, Part 1, pp. 43–46.) Intended primarily for measuring the phase change round the feedback loops of amplifiers. An accuracy within ± 3° is possible provided that the loop gain or loss does not exceed 40 db. The magnitudes of the voltages whose phases are to be compared are made equal by means of two special variable-gain amplifiers which cause the same phase change in received signals whatever their respective gains. The design of these amplifiers and of the necessary frequency changer is discussed and circuit diagrams are given.

621.317.784 **2003**

Pulse Power Measurement by a Heterodyne Method.—L. S. Schwartz. (*Communications*, Feb. 1949, Vol. 29, No. 2, pp. 26–27.) Pulse width and repetition rate need not be known. The r.f. pulse and c.w. oscillations of nearly the same frequency are applied to the square-law detector of a synchroscope receiver. The c.w. is adjusted so that the peak value of the variable component of the detection voltage equals the amplitude of the envelope of the r.f. pulse. The r.f. pulse power is then 6 db above the c.w. power at the point of entrance into the detector. Sources of error are discussed; accuracy is within a few per cent.

621.317.79 : 551.510.535 **2004**

Sweep Frequency Ionosphere Equipment.—P. G. Sulzer. (*J. appl. Phys.*, Feb. 1949, Vol. 20, No. 2, pp. 187–196.) The equipment records ionosphere virtual height as a function of frequency over the range 1–25 Mc/s. Special features of the device are high power output, good receiver sensitivity, and anti-jamming circuits. Detailed circuit diagrams are included. See also 2240 of 1948 (Thomas & Chalmers).

621.317.791 **2005**

A Self-Checking Wobbulator.—J. H. Vogelman. (*Communications*, Feb. 1949, Vol. 29, No. 2, pp. 28–31.) A portable test set for frequencies between 5 and 100 Mc/s, comprising a f.m. signal generator, frequency meter, and c.r.o. which can be used to measure the gain, frequency, bandwidth and tuning characteristics of wide-band i.f. and r.f. amplifiers and receivers.

621.317.35 + 621.396.615.17/.18 **2006**

Waveforms. [Book Review]—B. Chance, V. Hughes, E. F. MacNichol, D. Sayre & F. C. Williams (Eds). McGraw-Hill, London, 785 pp., £3. (*Wireless Engr*, April 1949, Vol. 26, No. 307, p. 139.) Vol. 19 of the M.I.T. Radiation Laboratory series. The book is more descriptive than analytic and deals mainly with non-linear circuits. The action of electronic switches, frequency multipliers and dividers, and counting circuits is discussed.

621.317.35 + 621.396.619 + 621.396.822 **2007**

Frequency Analysis, Modulation and Noise. [Book Review]—S. Goldman. McGraw-Hill, London, 1948, 434 pp., 36s. (*Electronic Engng*, April 1949, Vol. 21, No. 254, p. 152; *Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, p. 541.)

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

535.61-15 : 621.383 **2008**

Direct Recording of Spectra in the Region 1.2 μ to 3 μ using the Lead Sulfide Photo-Conductive Cell.—R. C. Nelson. (*J. opt. Soc. Amer.*, Jan. 1949, Vol. 39, No. 1, pp. 68–71.) See also 3330 of 1947 (Cashman).

621.317.39 **2009**

Electronic Gauges.—J. Schwartz. (*Microtecnic, Lausanne*, Jan./Feb. 1949, Vol. 3, No. 1, pp. 10–18. In English.) Conclusion of 1736 of June.

621.365.5 + 621.365.92 **2010**

High-Frequency Heating.—S. W. Scherer. (*Communication News*, Dec. 1947, Vol. 9, No. 2, pp. 45–55.) Discussion of both induction and dielectric heating, and of their applications. Several examples are given of apparatus designed for particular applications.

621.38.001.8 **2011**

The Electronic Brain.—W. R. Ashby. (*Radio-Electronics*, March 1949, Vol. 20, No. 6, pp. 77–80.) Reprint of 1144 of April.

621.38.001.8 **2012**

Electronics in the Service of Industry.—(*Radio tech. Dig., Édn franç.*, April 1949, Vol. 3, No. 2, pp. 105–111. Bibliography, pp. 111–113.) Brief general discussion, with some details of photoelectric counters and opacity meters.

621.38.001.8 : 061.3 **2013**

Papers Digested for Conference on Electronic Instrumentation.—(*Elect. Engng, N.Y.*, March 1949, Vol. 68, No. 3, pp. 246–251.) Authors' summaries of most of the papers read at the conference.

621.384.611.1† **2014**

A 20-MeV Betatron.—W. Bosley, J. D. Craggs, D. H. McEwan & J. F. Smee. (*Proc. Instn elect. Engrs*, Part I, March 1949, Vol. 96, No. 98, pp. 85–86.) Discussion on 179 of January.

621.384.611.1† **2015**

A New Type of [9-MeV] **Betatron without an Iron Yoke.**—A. Bierman. (*Nature, Lond.*, 23rd April 1949, Vol. 163, No. 4147, pp. 649–650.) Two coils are used in series, with a sealed-off glass acceleration tube between them. The dimensions are chosen so that the magnetic field at a point distant r from the centre is proportional to r^{-n}, where $0 < n < 1$. The flux required within the electron orbit is obtained by means of a small iron core along the axis. The current through the coils is obtained by periodical discharges of a 6.5-μF capacitor across a spark gap; these discharges occur every few seconds and initiate damped 2.5-kc/s oscillations, with a peak current of about 5 000 A. The whole betatron only weighs about 50 kg and the simple construction makes the cost low.

621.384.612.1† **2016**

Design for the Radiofrequency System for the 184-Inch Cyclotron.—K. R. MacKenzie, F. H. Schmidt, J. R. Woodyard & L. F. Wouters. (*Rev. sci. Instrum.*, Feb. 1949, Vol. 20, No. 2, pp. 126–133.) See also 1712 of 1948.

621.384.612.1† : 621.396.615 **2017**

Pulsed Oscillator for F. M. Cyclotron.—J. W. Burkig, E. L. Hubbard & K. R. MacKenzie. (*Rev. sci. Instrum.*, Feb. 1949, Vol. 20, No. 2, p. 135.)

621.384.621.1† **2018**

The High-Voltage Electrostatic Generator at the Atomic Energy Research Establishment.—R. L. Fortescue & P. D. Hall. (*Proc. Instn. elect. Engrs*, Part I, March 1949, Vol. 96, No. 98, pp. 77–85.) A 5-MV generator of the pressurized Van de Graaff type.

621.385.833 **2019**

Aberration Correction with Electron Mirrors.—E. G. Ramberg. (*J. appl. Phys.*, Feb. 1949, Vol. 20, No. 2, pp. 183–186.) Formulae for spherical and chromatic aberration are applied to a concave electron mirror with concentrated field distribution. The aberration coefficients of such mirrors are so large that this method of correction has serious practical difficulties.

621.396.615.17 : 615.849 **2020**

Electromedical Stimulators.—O. B. Sneath & E. G. Mayer. (*Wireless World*, April 1949, Vol. 55, No. 4, pp. 129–132.) Pulses are required of lengths between 1 sec and 10 μs, with repetition rates between 1 and 50 per sec and maximum output voltage of the order of 100 V at 100 mA. Circuits for producing such pulses are discussed.

621.398 **2021**

Radio Control of Mobile Miniatures.—E. L. Safford, Jr. (*CQ*, April 1949, Vol. 5, No. 4, pp. 18–21, 71.) A system for starting, stopping and steering model boats or cars.

PROPAGATION OF WAVES

538.566 **2022**

Unification of the Formulae representing the Principle of Huyghens for Electromagnetic Waves.—F. Croze & G. Darmois. (*C. R. Acad. Sci., Paris*, 7th March 1949, Vol. 228, No. 10, pp. 824–826.) Three conditions must be satisfied if a system of formulae is to be a physically and mathematically correct expression of Huyghens' principle. The formulae proposed successively by Love, Macdonald, Larmor, Bromwich, Schelkunoff, L. de Broglie, Novobatzky (for a finite surface) and Fränz all satisfy these three conditions; in consequence they can all be referred to a common form, which is here given. The condition that the secondary waves from the various elements of the surface considered must be pure e.m. waves is not satisfied by the formulae of Kirchhoff, nor by those proposed successively by Ignatowsky, Tonolo, Tedone, Kottler, Stratton & Chu and (for a closed surface) Novobatzky. This is shown by considering the case where the surface in question is a wave surface, either plane or of large radius. See also 1462 and 1463 of May.

538.566.2 **2023**

On the Propagation of Waves in an Inhomogeneous Medium.—O. E. H. Rydbeck. (*Chalmers tekn. Högsk. Handl.*, 1948, No. 74, 35 pp. In English.) A mathematical theory of propagation in an inhomogeneous or stratified medium is developed to determine the limiting conditions in which more approximate theories are applicable. For a slightly inhomogeneous medium, first and higher order approximations to the wave equations are obtained and their usefulness is estimated by application to special cases for which exact independent solutions exist. Large variations in refractive index are then considered. The results are compared with those of other methods. The theory is applied to the propagation of magneto-hydrodynamic waves in the sun and to the duct propagation of radio waves in the lower troposphere.

621.396.11 **2024**

The Effect of Pulsations of the Refractive Index of the Atmosphere on the Propagation of Ultra-Short Waves.—V. A. Krasil'nikov. (*Bull. Acad. Sci. U.R.S.S., sér. géogr. géophys.*, 1949, Vol. 13, No. 1, pp. 33–57. In Russian.) The usual interpretation of fading as a result of interference between the direct and indirect rays cannot be strictly correct, especially when transmission extends beyond the horizon. It is suggested that pulsations of the refractive index of the atmosphere due to temperature fluctuations may have an important bearing on fading. It is shown mathematically that when the scale of pulsations is smaller than the wavelength the waves are dispersed and when it is greater than the wavelength, path variations occur which lead to variations in intensity at the receiving point. Using the methods of geometrical optics and taking into account the results obtained by A. M. Obukhov (1928 above) formulae are derived for determining fluctuations of the amplitude and phase at the point of reception. Experimental results available in the literature are discussed in detail and are in general agreement with the proposed theory. It is concluded that: (*a*) when transmission is within the horizon, u.s.w. fading can be explained by the temperature fluctuations of the atmosphere; (*b*) fading when transmission is somewhat beyond the horizon is mainly caused by the interference between the two components but it is also necessary to take into account the effect of the temperature fluctuations on both components; (*c*) at very great distances, when reception is carried out only on the indirect ray, the temperature-fluctuation effect again becomes predominant.

621.396.11 : 551.5 **2025**

An Extension of Macfarlane's Method of Deducing Refractive Index from Radio Observations.—A. W. Straiton. (*J. appl. Phys.*, Feb. 1949, Vol. 20, No. 2, p. 228.) Comment on 2894 of 1947. The second set of height-gain measurements there suggested can be replaced by a set of height/phase measurements; a suitable method of measuring phase was discussed in 3225 of 1948 (Straiton & Gerhardt).

621.396.11 : 551.510.535 **2026**

Absorption of Radio Waves Reflected at Vertical Incidence as a Function of the Sun's Zenith Angle.—E. W. Taylor. (*Bur. Stand. J. Res.*, Dec. 1948, Vol. 41, No. 6, pp. 575–579.) Analysis of Central Radio Propagation Laboratory records extending over 3 years indicates that absorption depends approximately linearly on the cosine of the sun's zenith angle.

621.396.11 : 551.510.535 **2027**

A Note on the Ionospheric Absorption Problem.—L. G. McCracken. (*J. appl. Phys.*, Feb. 1949, Vol. 20, No. 2, pp. 229–230.) The formula for the total nondeviating E-layer absorption derived by Best & Ratcliffe (1748 of 1938) is here obtained without using certain of their approximations. Appleton (395 of 1938) obtained a similar formula.

621.396.11 : 551.510.535 **2028**

The Ionosphere over Mid-Germany in February 1949.—Dieminger. (*See* 1934.)

621.396.11 : 551.510.535 **2029**

Changes in Radio Reception during Sunspot Period '45-47.—H. T. Stetson. (*Tele-Tech*, Dec. 1948, Vol. 7, No. 12, pp. 29 . . 73.) Summary of Amer. Astr. Soc. paper. Variations of both F_2 critical frequencies and of field intensities at 5 and 10 Mc/s with variations of sunspot activity are recorded for the recent rise period. Diurnal field-intensity changes to be expected during the decline period are discussed.

621.396.11 : 551.510.535 : 523.3 **2030**

Moon Echoes and Penetration of the Ionosphere.—F. J. Kerr, C. A. Shain & C. S. Higgins. (*Nature, Lond.*, 26th Feb. 1949, Vol. 163, No. 4139, pp. 310–313.) The possibility of using reflections from the moon to extend the study of the ionosphere is investigated. Stations VLC9 and VLB5 operating at frequencies near 20 Mc/s were used. The equipment and the experimental procedure are described. Echoes were obtained in 13 out of 15 trials. Wide variations in the amplitude of echoes were recorded; on no occasion did the amplitude exceed the theoretical value. Fading periods of 1 sec or less were observed, similar to those experienced with ionospheric reflections. Echo frequencies were about 50 c/s higher than those of the transmitted signal, mainly because of the Doppler effect of the earth's rotation. As the moon rose, echoes could not be obtained as soon as could be expected from calculations based on vertical-incidence ionospheric soundings.

Analysis of 20-Mc/s solar noise also shows ionospheric effects, with the significant difference that solar noise energy is received at unexpectedly low elevations of the sun.

621.396.812.029.62 **2031**

On Normal and Abnormal Refraction of Ultra-Short Waves in the Atmosphere.—H. H. Klinger. (*Z. Met.*, March 1948, Vol. 2, No. 3, p. 86.) Field-strength records of u.s.w. transmissions ($\lambda = 1.3$ m) over a 63-km path, about 40% beyond the optical range, are briefly discussed. The considerable increases of field-strength occasionally observed are accompanied by relatively little fluctuation and can be attributed to certain local characteristics of the lower atmosphere.

621.396.812.029.64 **2032**

Effect of the Atmosphere on Microwaves.—H. H. Klinger. (*Z. Met.*, Oct. 1948, Vol. 2, No. 10, pp. 314–316.) Measurements of received signal strength for $\lambda = 1.36$ cm showed strong absorption due to rain or even a slightly damp atmosphere, whereas 3.6-cm waves under the same conditions were not appreciably affected. Further investigations with wavelengths of 1–10 mm are proposed.

621.396.812.029.64 **2033**

Low-Level Atmospheric Ducts.—R. F. Jones: J. S. McPetrie & B. Starnecki. (*Nature, Lond.*, 23rd April 1949, Vol. 163, No. 4147, p. 639.) Comment on 1167 of April. Jones explains the presence of the ducts observed both in cold and warm weather in terms of the previous history of the air at heights between 200 and 2 000 ft. McPetrie & Starnecki consider that although Jones' hypothesis is satisfactory for periods of high wind-velocity, low air temperature rather than high wind-velocity is the main cause of the cold-weather ducts.

621.396.812.029.64 **2034**

Oversea Propagation on Wavelengths of 3 and 9 Centimeters.—J. S. McPetrie, B. Starnecki, H. Jarkowski & L. Sicinski. (*Proc. Inst. Radio Engrs, W. & E.*, March 1949, Vol. 37, No. 3, pp. 243–257.) For other accounts of results obtained at the same sites see 518 of 1947 (Megaw) and 2329 of 1948 (McPetrie & Starnecki).

621.396.812.3 **2035**

A Peculiar Type of Rapid Fading in Radio Reception.—N. S. Subba Rao & Y. V. Somayajulu. (*Nature, Lond.*, 19th March 1949, Vol. 163, No. 4142, p. 442.) Discussion of the 'flutter phenomenon', a variation in intensity observed at Waltair, India, when receiving broadcast transmissions on wavelengths of 41 m and 60 m. The effect is observed occasionally on a wavelength of 19 m, but is completely absent at m.f. The flutter occurs only during the hot season (February–June) and begins about sunset; the fluctuation frequency is very low (0.3–0.5 c/s) before sunset, and increases to 2–2.4 c/s early in the night, thereafter remaining constant for long periods. The ionosphere must be the cause of this phenomenon, which may be due to the rapid movement of ionic clouds across the F layer. See also 3279 of 1946 (Wells, Watts & George).

621.396.812.3 : 551.510.535 **2036**

Short-Range Fading of Broadcasting Transmissions.—W. Gerber & A. Werthmüller. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Feb. 1947, Vol. 25, No. 1, pp. 1–12. In German.) The reflecting properties of the ionosphere in the medium-wave band are discussed. The fine structure of the fading diagram is attributed to interference effects, while the main features are principally determined by absorption and are related both to the sunspot period and to the season, with maximum fading effects in spring and autumn and minimum occurrence in summer and winter. The solar effects are superposed on the seasonal effects and are greatest at sunspot minimum and least at sunspot maximum. Curves are given showing the average fading effects for the Beromünster transmitter as observed at St. Gallen, at different times during the evening, from April 1936 to November 1946. The curves all show maxima about 1944, with subsidiary peaks about 1941 and minima near 1938.

621.396.812.3.029.54 **2037**

Space-Wave Absorption and Large-Scale Weather Conditions.—G. Falckenberg & E. Lauter. (*Z. Met.*, Sept. 1948, Vol. 2, No. 9, pp. 259–265.) Transmissions from Kalundborg on $\lambda = 1\,250$ m were observed at Warnemünde, 180 km distant. In the daytime the transmissions were almost completely absorbed by the ions in the lower part of the ionosphere, but at night the absorption showed wide variations related to projections into the ionosphere of equatorial or polar air masses. A connection between the absorption and air pressure variations at a height of 9 km was also established.

RECEPTION

621.396.619.13 : 621.392 **2038**

Distortion of Frequency-Modulated Signals in Electrical Networks.—F. L. H. M. Stumpers. (*Communication News*, April 1948, Vol. 9, No. 3, pp. 82–92.) Long summary of part of the thesis noted in 2221 of 1947. See also 1886 of 1948.

621.396.621 + 621.396.61] : 551.510.535 **2039**

Ionosphere Sounding [equipment].—Maguer. (*See* 2069.)

621.396.621 : 621.392.52 : 621.396.5 **2040**

Application of Crystal Filters in [telegraphy] **Receivers.**—Maarleveld. (*See* 1892.)

621.396.621 : 621.396.5 **2041**

A Modern Receiver for Radiotelegraphy.—C. T. F. van der Wyck. (*Tijdschr. ned. Radiogenoot.*, March 1949, Vol. 14, No. 2, pp. 27–39. Discussion, p. 40. In Dutch, with English summary.) Description, with block diagram, of the receiver, and discussion of (*a*) considerations leading to its design, (*b*) automatic tuning control, (*c*) conditions for a stable circuit. See also 3510 of 1948 and 1892 above.

621.396.81 : 621.396.9 **2042**
Signal/Noise Ratio in Radar.—S. de Walden. (*Wireless Engr*, April 1949, Vol. 26, No. 307, pp. 140–141.) Comment on 2899 of 1948 (Levy).

621.396.826 : 621.396.933.2 : 621.396.619.16 **2043**
Elimination of Reflected Signal Effects in Pulsed Systems.—Collup. (*See* 1945.)

621.396.822 + 621.317.35 + 621.396.619 **2044**
Frequency Analysis, Modulation and Noise. [Book Review]—Goldman. (*See* 2007.)

STATIONS AND COMMUNICATION SYSTEMS

621.39.001.11 **2045**
Evaluation of Transmission Efficiency according to Hartley's Expression of Information Content.—A. G. Clavier. (*Elect. Commun.*, Dec. 1948, Vol. 25, No. 4, pp. 414–420.) Transmission efficiency, defined by extending Hartley's expression for telegraphic signals to telephony in presence of noise, is calculated for the main pulse-transmission systems. The resulting expressions enable the various systems to be compared, although simplicity and cost of equipment will also be important factors in deciding their relative merits. See also 515 of February (Landon) and 1361 of May (Shannon).

621.395.43/.44 **2046**
Study of the General Characteristics of the L.T.T. 12-Channel Carrier-Current System for Overhead Lines.—H. Pech. (*Câbles & Transmission, Paris*, April 1949, Vol. 3, No. 2, pp. 177–193.) General problems in connection with such systems are discussed, including (*a*) attenuation within the prescribed transmission band, (*b*) characteristic impedance of actual lines, (*c*) crosstalk, and (*d*) noise. A description is given of equipment constructed for the French Post Office. The frequency band covered is 30–150 kc/s. Details are included of the modulation and demodulation processes, terminal equipment, filters, equalizers and carrier-frequency generators. Test results on prototype equipment will be published later.

621.396.1 : 621.397.5 **2047**
Allocation of Frequencies for the Television Service.—F. C. McL. (*B.B.C. Quart.*, April 1949, Vol. 4, No. 1, pp. 54–56.) The frequency band at present allocated is 41–66.5 Mc/s; it is hoped that the upper limit will shortly be raised to 68 Mc/s. For all new stations asymmetric-sideband transmission will be used to enable 5 exclusive channels to be obtained in the full band, but transmissions from Alexandra Palace will remain unchanged.

621.396.619.13/.14 : 534.78 **2048**
Ratio of Frequency Swing to Phase Swing in Phase- and Frequency-Modulation Systems Transmitting Speech.—D. K. Gannett & W. R. Young. (*Proc. Inst. Radio Engrs, W. & E.*, March 1949, Vol. 37, No. 3, pp. 258–263.) Theoretical and experimental results are discussed. The ratio was found to vary with different voices, with the microphone and circuit characteristics, and with the kind of volume regulation used.

621.396.65.029.63 **2049**
Choice of Suitable Heights [of stations], **Distance and Wavelengths in Planning Decimetre-Wave Links.**—A. Grün. (*Fernmeldetech. Z.*, March 1949, Vol. 2, No. 3, pp. 69–72.) In the case of decimetre-wave systems, fading is due chiefly to interference between the direct ray and that reflected from an intermediate point of the earth's surface. Calculations show that in order to obtain as great a received field-strength as possible, with little fading, the wavelength for a given distance between stations should not be too small and optimum heights should be chosen for the aerials. Formulae are given from which the optimum heights can be calculated, with curves for ranges of 50 km and 60 km respectively and wavelengths from 10 cm to 100 cm.

621.396.712.2 **2050**
WMGM Master Control Equipment Design.—M. E. Gunn. (*Audio Engng, N.Y.*, March 1949, Vol. 33, No. 3, pp. 24–28 . . 40.) Details, including block diagram, of a high-power broadcast station installation.

621.396.9 : 523.3 **2051**
Detection of Radio Signals Reflected from the Moon.—DeWitt & Stodola. (*See* 1937.)

621.396.619 + 621.317.35 + 621.396.822 **2052**
Frequency Analysis, Modulation and Noise. [Book Review]—Goldman. (*See* 2007.)

SUBSIDIARY APPARATUS

621.316.722.077.65 : 621.396.68 **2053**
Commutation in Rectifiers using Relay Tubes: Parts 1 & 2.—T. Douma. (*Communication News*, April & Aug. 1948, Vol. 9, Nos. 3 & 4, pp. 70–81 & 110–120.) A detailed discussion of the behaviour of the well-known 3-phase Graetz circuit, taking account of the effect of leakage inductance and self-capacitance in the power transformer. Means of protecting this transformer from steep-fronted voltage surges are also indicated. The control characteristic of grid-controlled rectifiers is discussed in an appendix.

621.316.726 **2054**
Frequency Correction Equipment for Railway Signalling Supplies.—(*Engineer, Lond.*, 18th Feb. 1949, Vol. 187, No. 4856, pp. 184–186.) A 10-kVA induction motor has a 440-V three-phase stator and a single-phase rotor, the speed of which is controlled by a frequency-selective relay so that the rotor output frequency is between 49.7 and 50.3 c/s even though the frequency of the stator input varies from 47.5 to 51.4 c/s. An electronic frequency corrector is also described which rectifies the variable-frequency supply and reconverts the d.c. into a.c. at the required frequency by means of inverting valves and a timing unit. Both kinds of equipment are operated by remote automatic control. See also *Engineering, Lond.*, 8th April 1949, Vol. 167, No. 4341, pp. 331–332.

TELEVISION AND PHOTOTELEGRAPHY

621.397.26 **2055**
Ultrafax.—D. S. Bond & V. J. Duke. (*RCA Rev.*, March 1949, Vol. 10, No. 1, pp. 99–115.) See also 1203 of April.

621.397.5 **2056**
Polycast System for TV on U.H.F.—R. M. Wilmotte & P. A. Demars. (*FM-TV*, Dec. 1948, Vol. 8, No. 12, pp. 26–28 . . 46.) For the U.S. u.h.f. television band, the power required to obtain satisfactory coverage at all points within say 30 miles of a single transmitter is prohibitive. 'Polycasting' is a suggested alternative, using ten to fifteen 200-W transmitters within the area, each covering an area of 10 miles radius.

621.397.5 : 535.88 : 791 **2057**

Theater Television.—(*J. Soc. Mot. Pict. Engrs*, March 1949, Vol. 52, No. 3, pp. 243–267. Bibliography, pp. 268–272.) Report, in language as little technical as possible, of the Theater Television Committee of the Society of Motion Picture Engineers on the present state of the art.

621.397.5 : 621.3.09 **2058**

Attenuation and Phase Distortion and their Effect on Television Signals.—Fuchs & Baranov. (*See* 1871.)

621.397.5 : 621.315.212 **2059**

The London-Birmingham Television Cable : Part 2 — Cable Design, Construction and Test Results.—Stanesby & Weston. (*See* 1857.)

621.397.5 : 621.396.1 **2060**

Allocation of Frequencies for the Television Service.—McL. (*See* 2047.)

621.397.6 : 621.385.832 **2061**

The Graphechon — A Picture Storage Tube.—L. Pensak. (*RCA Rev.*, March 1949, Vol. 10, No. 1, pp. 59–73.) 1949 I.R.E. National Convention paper. Describes the combination, within one envelope, of a c.r. tube and an iconoscope, enabling a picture written once on the common screen to be scanned continuously for 1–2 minutes. The picture is recorded on the screen by use of the fact that the thin insulating layer on the iconoscope target becomes conductive at the point of impact of a high-velocity electron beam. The picture is read by the conventional iconoscope method. The graphechon was designed originally in connection with the teleran navigation system.

621.397.6 : 621.395.667 **2062**

Phase and Amplitude Equalizer for Television Use.—Goodale & Kennedy. (*See* 1893.)

621.397.61 : 621.3.015.3 **2063**

Standardization of the Transient Response of Television Transmitters.—R. D. Kell & G. L. Fredendall. (*RCA Rev.*, March 1949, Vol. 10, No. 1, pp. 17–34.) It is suggested that picture-monitoring receivers for vestigial-sideband television transmitters should now be standardized on the basis of response to a double-sideband signal modulated by a square wave. Tolerances for vestigial-sideband transmitter performance could then be defined by the shape of the monitor receiver response when the transmitter is modulated by a square wave. Phase-correction networks for reducing the distortion introduced by the vestigial-sideband system and by the restricted bandwidth used are also discussed.

621.397.61-182.3 **2064**

The WMAL-TV Mobile TV Unit.—F. W. Harvey & E. D. Hilburn. (*Communications*, March 1949, Vol. 29, No. 3, pp. 8–11, 31.) An illustrated description.

621.397.62 **2065**

Experimental Television Receiver.—(*Télévis. franç.*, March 1949, No. 45, pp. 13–16, 21.) Circuit diagrams and complete details of a receiver using a small e.s. c.r. tube with a screen only 7 cm in diameter, and capable of receiving either the present 450-line or the proposed 819-line transmissions.

621.397.62 : 621.396.662 **2066**

Simplified TV Receiver Channel Switching Mechanism.—J. A. Hansen. (*Tele-Tech*, Dec. 1948, Vol. 7, No. 12, pp. 36–38, 72.) A compact 12-channel superheterodyne tuner which uses a sliding carriage to carry the tuning elements. The sound i.f. is about 21.75 Mc/s and the vision i.f. 26.25 Mc/s. Performance is discussed.

621.397.743(73) **2067**

Television in 1949 — Stations and Networks [in the U.S.A.].—(*Tele-Tech*, Dec. 1948, Vol. 7, No. 12, Supplement.) Map and brief tabulated data of stations now existing or under construction.

621.397.823 : 629.135 **2068**

Television Interference by Aircraft.—A. H. Cooper. (*Wireless World*, April 1949, Vol. 55, No. 4, pp. 142–145.) The use of directive receiving aerials reduces the region within which an aircraft causes interference, but a greater all-round reduction of interference is usually obtained by raising the receiving aerial. Removal of the d.c. component from the received signal eliminates fluctuations in picture brightness; the changes in contrast due to the interference are not then so noticeable. The design of a filter to attenuate frequencies between 1 c/s and 25 c/s, to mitigate some disadvantages of removing the d.c. component, is discussed.

TRANSMISSION

621.396.61 + 621.396.621] : 551.510.535 **2069**

Ionosphere Sounding [equipment].—P. Maguer. (*Radio franç.*, April 1949, No. 4, pp. 7–12.) Description, with complete circuit diagrams, of (*a*) a transmitter giving 50-μs pulses with peak power of 1.6 kW and recurrence frequency of 50 per sec, and (*b*) a wide-band superheterodyne receiver with good sensitivity, in which a c.r.o. sweep circuit of simple design gives a height-scale accuracy approximating to that obtained with a crystal oscillator and its somewhat complex frequency-division circuits.

621.396.61 : 621.316.726 **2070**

Frequency Control in Transmitters.—H. B. R. Boosman & E. H. Hugenholtz. (*Communication News*, Sept. 1947, Vol. 9, No. 1, pp. 21–32.) Discussion of various methods of obtaining high stability of frequency and accuracy of tuning, including methods involving the principles of frequency-adjustment control and decade tuning. A number of discriminator circuits and circuits suitable for synchronization with a high harmonic of a control frequency are also described.

621.396.61 : 621.316.726 **2071**

Telesynchronization with Standard Frequency.—L. Rohde & R. Leonhardt. (*Fernmeldetech. Z.*, March 1949, Vol. 2, No. 3, pp. 85–90.) Detailed discussion of methods of phase and frequency synchronization, with particular reference to the control of common-wave broadcasting transmitters. Methods of deriving a control voltage from the phase or frequency difference between the standard and the local generator are described. The case where the ratio of the standard and local frequencies is that of two reasonably small integers is also considered.

VALVES AND THERMIONICS

621.383 **2072**

Lead Selenide Photoconductive Cells.—C. J. Milner & B. N. Watts. (*Nature, Lond.*, 26th Feb. 1949, Vol. 163, No. 4139, p. 322.) Cells prepared by an experimental chemical deposition process are found to have a broad sensitivity maximum at 3–4 μ. Appreciable sensitivity has so far only been exhibited at low temperatures.

621.383 **2073**

Bismuth Sulphide Photocells.—B. T. Kolomiets. (*Zh. tekh. Fiz.*, Jan. 1949, Vol. 19, No. 1, pp. 126–131. In Russian.) The photocells are made with synthetic Bi_2S_3. Various experimental characteristics are plotted. This type of cell is particularly suitable for automatic control applications.

621.383 **2074**

Photoelectric Multipliers.—S. Rodda. (*J. sci. Instrum.*, March 1949, Vol. 26, No. 3, pp. 65–70.) Discussion of fundamental principles, emissive materials, electrode shapes, current fluctuations, dark current, fatigue phenomena, practical circuits, applications etc.

621.383 : 535.215 **2075**

On the Interpretation of Observations on the Photoelectric Voltages with Intermittent Light.—Gorter, Broer & Snoek. (*See* 1916.)

621.383 : 535.215 **2076**

On Photoelectric Voltages in Light-Absorbing Materials.—Snoek & Gorter. (*See* 1915.)

621.383 : 621.396.645 **2077**

The Development of a Photoelectric A.C. Amplifier with A.C. Galvanometer.—Milatz & Bloembergen. (*See* 1908.)

621.385 **2078**

Standard Valves. [Book Review]—Standard Telephones and Cables, 1947, 328 pp., 15s. (*Nature, Lond.*, 12th March 1949, Vol. 163, No. 4141, p. 387.) Details and technical data of ordinary valves, c.r. tubes, cold-cathode relays, v.m. valves and disk-seal u.h.f. triodes manufactured by the above firm. Brimar valves are not included.

621.385 **2079**

New Miniature American-Type Valves made in France.—M. Leroux. (*Radio prof., Paris*, March & April 1949, Vol. 18, Nos. 171 & 172, pp. 6–9, 18–20 . . 23.) Full technical details, with operational characteristics and practical circuits. The valves include pentodes 6AG5, 6AU5, 6BA6, 6AK5, output valves 6AQ5 and 6AK6, double-diode triode 6AT6, diode 6AL5, double triode 6J6, high-μ triode 6J4, rectifier 6X4, and a.c./d.c. valves 12BE6, 12BA6, 12AT6 and 12AV6 which are identical with the corresponding 6-V valves except that their heater current is 0.15 A at 12.6 V.

621.385 **2080**

A New Series of Small Radio Valves.—G. Alma & F. Prakke. (*Philips tech. Rev.*, Oct. 1946, Vol. 8, No. 10, pp. 289–295.) Discussion of the 'A' series or Rimlock valves, 22 mm in diameter, for which overheating of the cathode is avoided by joining the glass or metal bulb to the flat glass base with a glaze or cement which becomes plastic at a comparatively low temperature.

621.385 **2081**

New Post-War German Valves.—(*Radio Tech., Vienna*, April 1949, Vol. 25, No. 4, p. 249.) Brief particulars of 15 valves, including type of base and of body and, in some cases, heater voltage and current. Output data are included for 3 new developments: UEL71 and VEL11, 2-W tetrode/pentodes, and UL2, a 1.5-W output pentode.

621.385 **2082**

Series of Modern Valves for F.M. Broadcasting and for Television.—J. Becquemont. (*Onde élect.*, April 1949, Vol. 29, No. 265, pp. 145–151.) Discussion of methods of achieving small interelectrode distances, high electron densities, high anode dissipation, low reaction capacitance and output impedance, high gain and complete separation of input from output. The use of Dilver-P, an alloy comparable to kovar, together with a glass of the same expansion coefficient has made possible the construction of a series of valves in which the various electrodes are carried on concentric cylinders, which form the base connections. The operation of welding the Dilver-P cylinders to the intermediate glass rings to form the valve base is carried out in a high-temperature furnace, using a graphite mandrel. This construction gives short connections to the electrodes. Illustrations are given of a 500-W triode and a 2-kW tetrode with anode cooling fins.

621.385 **2083**

Theory and Applications of Trochotrons.—H. Alfvén; L. Lindberg; K. G. Malmfors; T. Wallmark; E. Åström. (*Kungl. tekn. Högsk. Handl., Stockholm*, 1948, No. 22, 106 pp. In English.) Includes 5 separate but co-ordinated papers. The first, "On Trochoidal Electronic Beams and their Use in Electronic Tubes (Trochotrons)", by Alfvén, is an integrating paper. The equations of motion of charged particles in a nearly homogeneous magnetic field perpendicular to a nearly homogeneous electric field are discussed, and the properties of the resulting trochoidal beams are considered in detail. The arrangement of a simple trochotron is described. The cathode is an electron gun, placed between an L-shaped anode and a straight 'rail' electrode at nearly cathode potential. The electron beam travels between the 'rail' and a number of 'boxes'. The anode forms one side of the last box, while the side of the first box remote from the cathode is connected to the rail. Electrodes forming sides of the boxes, at right angles to the rail, are called spades; those forming sides parallel to the rail are called plates. All spades and plates, and the anode, are normally at a potential of + 200 V relative to the cathode, except the spade connected to the rail. The beam may enter the first box and be collected by the first plate. The beam can be made to enter one of the other boxes by altering the voltage of the corresponding spade. For earlier work see 3800 of 1945 and 1205 of 1948.

The second paper, "Design and Properties of Trochotrons", by Wallmark, discusses the trochotron in greater detail, with illustrations of the way in which the beam behaves when some electrode voltages are changed by steps. Operating conditions, the size of the electrode system, electrode materials etc., are considered.

The third paper, "Design of Trochotron Circuits", by Lindberg, discusses the way in which external pulses may be used to operate each spade as a self-locking switch. Applications to counters, chronoscopes and pulse-time modulation are also considered.

The fourth paper, "Experimental Investigation on an Electron Gas in a Magnetic Field", by Åström, discusses experimental results concerning currents which flow to electrodes whose potential is negative relative to the cathode. These 'negative currents' are always accompanied by noise. They occur even if there is no alternating voltage on the electrodes. This phenomenon is related to cut-off effects in magnetrons.

The fifth paper, "On the Instability of an Electron Gas in a Magnetic Field", gives theory primarily proposed as an explanation of Åström's results, but it may also throw light on the origin of solar and cosmic noise.

621.385 **2084**

Valves with Resistive Loads.—S. W. Amos. (*Wireless Engr*, April 1949, Vol. 26, No. 307, pp. 119–123.) Expressions are derived for the maximum undistorted output that can be delivered to a purely resistive load by a valve with given h.v. supply. Although the expressions are derived for the cathode-follower circuit, many of the formulae may be applied to valves with the load in the anode circuit.

621.385 **2085**

Some Recent Developments in the Technique of Radio Valve Manufacture.—J. W. Davies, H. W. B. Gardiner & W. H. Gomm. (*Proc. Instn mech. Engrs, Lond.*, 1948, Vol. 158, No. 3, pp. 352–363. Discussion, pp. 364–368.) A general account of the mechanical aspects of the manufacture of large transmitting and h.f. valves, with particular attention to the making of spiral, squirrel-cage and planar grids, glass-to-metal joints of the annular type, using chucks for holding the component parts, and the assembly and alignment processes.

621.385 : 061.3 **2086**

Digests of Papers Presented at Conference on Electron Tubes.—(*Elect. Engng, N.Y.*, June 1948, Vol. 67, No. 6, pp. 589–600.) Authors' summaries of most of the papers read are given. Full texts are being published in the *Proceedings of the Conference on Electron Tubes* (price $3). The *Report on Electron Tube Survey* (price $2) prepared by an A.I.E.E. Committee, contains data on which much information discussed at the conference was based. Both are obtainable from A.I.E.E. Order Department, 33, West 39th Street, New York 18, N.Y.

621.385 : 621.396.822 **2087**

The Noise Factor of Grounded-Grid Valves.—A. van der Ziel & A. Versnel. (*Philips Res. Rep.*, Aug. 1948, Vol. 3, No. 4, pp. 255–270.) A mathematical treatment of grounded-grid valves in which part of the output noise current also flows in the input circuit, giving partial noise suppression. Triodes, pentodes and secondary-emission valves are considered, and the effects of circuit and dielectric losses, transit time, field inhomogeneities, partition noise and secondary-emission noise are discussed.

Measurements made on valves for $\lambda = 7.25$ m agree with theory for curves of noise factor against aerial resistance, and for noise resonance curves. Loose aerial coupling favours a low noise factor, but complete noise suppression is impossible. Suppression is most effective for grounded-grid triodes over a narrow frequency band, so that this type of valve is less useful for wide-band working. The noise factor for secondary-emission valves is much greater than that for triodes. See also 249 of January.

621.385.029.63/.64 **2088**

Some Slow-Wave Structures for Travelling-Wave Tubes.—L. M. Field. (*Proc. Inst. Radio Engrs, W. & E.*, Jan. 1949, Vol. 37, No. 1, pp. 34–40.) The gain per unit length of a travelling-wave valve is determined by a structure factor. Four types of structure are compared, namely (*a*) helix, (*b*) disk-loaded rod, (*c*) apertured-disk, and (*d*) helical waveguide. Amplifier performance of helix valves at 10 000 Mc/s and wide-tuned oscillator performance (1.5 to 1) with second-harmonic output around 20 000 Mc/s are considered. Design, construction and performance of a 10 000-Mc/s valve of type (*b*) are also discussed.

621.385.029.63/.64 **2089**

Effect of the Transverse Electric Vector in the Delay Line of the Travelling-Wave Valve: Part 1.—O. Doehler & W. Kleen. (*Ann. Radioélect.*, Jan. 1949, Vol. 4, No. 15, pp. 76–84.) The hypotheses used in different theories of the linear behaviour of the travelling-wave valve are briefly reviewed and the effect of the transverse electric field of the delay line on the interaction between the beam and the wave is examined. This effect appears to have been neglected hitherto. The radial field causes five waves to be excited instead of the three found on the hypothesis of a purely longitudinal field; the gain of the amplified waves can be appreciably increased by the action of the radial field. Particular types of delay line where such effects predominate are discussed and the change of gain due to the space charge and to the absorption of electrons by the delay line is studied. To be continued. See also 1543 of May (Pierce).

621.385.032.216 **2090**

Fluctuation Effects of Emission from Oxide-Coated Surfaces.—R. P. Bien & Yang Yo-Han. (*Science Rec., Nanking*, Oct. 1947, Vol. 2, No. 1, pp. 65–70. In English.) Fluctuations observed bear no relation to heating current but can be explained statistically.

621.385.032.216 **2091**

Thermionic Emission from Oxide Coated Cathodes.—D. A. Wright. (*Proc. phys. Soc.*, 1st March 1949, Vol. 62, No. 351B, pp. 188–203.) Discussion of an experimental investigation of the emission from Ba/Sr oxide cathodes and from thoria cathodes under pulsed and d.c. conditions. Semiconductor theory can explain the emission and conductivity of cathode coatings. The part played by the interface layers between the coating and the metal to which it is applied is also considered. For earlier work see 606, 1980 and 1981 of 1948.

621.385.032.216 **2092**

Poisoning in High-Vacuum Oxide-Cathode Valves.—G. H. Metson & M. F. Holmes. (*Nature, Lond.*, 8th Jan. 1949, Vol. 163, No. 4132, pp. 61–62.) The ionizing action of the current after leaving the cathode surface is suggested as the prime factor leading to cathode deterioration. Results of life tests on two batches of a particular type of pentode are discussed. Those arranged as triodes with anodes strapped to screen and suppressor grids and primed with 200 V failed after 500–1 000 hr, whereas those connected as diodes, with control grids acting as collectors and +2 V applied between grid and cathode to give a cathode current of about 12 mA, showed little deterioration after 6 000 hr.

621.385.032.216 **2093**

Resistance of Oxide Cathode Coatings for High Values of Pulsed Emission.—W. E. Danforth & D. L. Goldwater. (*J. appl. Phys.*, Feb. 1949, Vol. 20, No. 2, pp. 163–173.) The potential variation of fine ribbon probes embedded in standard BaO or SrO coatings was observed for 19 valves. Potential gradients were found adequate to admit dielectric breakdown as a cause of sparking. The resistance of SrO cathodes is several times that of BaO or mixed-oxide cathodes. Superposition of d.c. upon pulsed emission causes a marked decrease in resistance.

621.385.032.216 **2094**

Work Functions and Conductivity of Oxide-Coated Cathodes.—G. W. Mahlman. (*J. appl. Phys.*, Feb. 1949, Vol. 20, No. 2, pp. 197–202.)

621.385.032.42 **2095**

A New Air-Cooling System for Transmitting Valves.—W. L. Vervest. (*Communication News*, April 1948, Vol. 9, No. 3, pp. 92–96.) See also 2673 of 1948 (de Brey & Rinia).

621.385.032.5 : 666.1.037.5 **2096**

The Electrode Leads of Transmitting Valves.—E. G. Dorgelo. (*Communication News*, Dec. 1947, Vol. 9, No. 2, pp. 38–44.) Survey and discussion of various methods of sealing.

621.385.2 : 621.396.822 **2097**

Noise Spectrum of Temperature-Limited Diodes.—D. B. Fraser. (*Wireless Engr*, April 1949, Vol. 26, No. 307, pp. 129–132.) A simple and completely general derivation of the formula for the fluctuation currents in plane and cylindrical diodes, with explicit allowance for the transit time. When transit time is negligible, the formula reduces to that of Schottky.

621.385.2 : 621.396.822 **2098**

Noise Spectrum of a Diode with a Retarding Field.—J. J. Freeman. (*Bur. Stand. J. Res.*, Jan. 1949, Vol. 42, No. 1, pp. 75–88.) A general expression is derived for the spectrum generated by the random emission of electrons having arbitrary trajectories within a waveguide. A numerical solution is obtained for the potential distribution within a plane diode; results are shown as a series of curves, and compared with von Laue's results. The equivalent mean-square fluctuation current due to the space charge within a diode is deduced for (*a*) linear potential distribution, and (*b*) the distribution which occurs near the beginning of the retarding field. In case (*a*), the equivalent noise temperature of the diode conductance is equal to the cathode temperature.

621.385.2.032.216 **2099**

Some Characteristics of Diodes with Oxide-Coated Cathodes.—W. R. Ferris. (*RCA Rev.*, March 1949, Vol. 10, No. 1, pp. 134–149.) The Epstein-Fry-Langmuir equation for the space-charge current in a plane diode and the Boltzmann equation for the retarding-field current are used to obtain a set of universal characteristic curves for plane diodes; $V.|e/kT|$ is taken as the abscissa. These curves agree with experimental measurements when a series resistance is assigned to the oxide cathode. Universal curves of incremental conductance and tables of functions used are given.

621.385.3.029.64 **2100**

Electronics of Ultra-High-Frequency Triodes.—R. R. Law. (*Proc. Inst. Radio Engrs, W. & E.*, March 1949, Vol. 37, No. 3, pp. 273–274.) An empirical relation is deduced for anode efficiency as a function of frequency, voltage and interelectrode spacing.

621.385.3.032.29 : 621.317.335.2† **2101**

Triode Interelectrode Capacitances.—E. E. Zepler & J. Hekner. (*Wireless Engr*, Feb. 1949, Vol. 26, No. 305, pp. 53–58.) The variations of grid/cathode and grid/anode capacitance with working conditions were investigated experimentally. The effects of the mutual conductance, amplification factor and supply voltages are shown graphically. A theory is given which is in fair agreement with these results.

621.385.3.032.29 : 621.317.335.2† **2102**

Interelectrode Capacitance of Valves.—B. L. Humphreys & E. G. James. (*Wireless Engr*, Jan. 1949, Vol. 26, No. 304, pp. 26–30.) Discussion of measurements made under different operating conditions, on two types of valve—DET22 and E1714—whose active elements are all cylindrical and coaxial. The measurements were made on a r.f. bridge at a frequency of 1 Mc/s. The increase of grid/cathode capacitance with increasing anode current was much greater than that expected theoretically and depended greatly on the grid/cathode geometry. Anode/grid capacitance decreased very slightly with increasing anode current.

621.385.832 : 621.397.6 **2103**

The Graphechon — A Picture Storage Tube.—Pensak. (*See* 2061.)

621.396.615.142 : 621.316.726 **2104**

Frequency Stabilization of V.M. Valves.—H. Borg. (*Wireless Engr*, Feb. 1949, Vol. 26, No. 305, pp. 59–73.) A simplified discussion of general principles mainly in connection with c.w. microwave oscillators. Frequency control systems are considered in which an error voltage, generated between a standard reference frequency source and the oscillator to be stabilized, is used to correct frequency variations of the oscillator. An application is described in which the frequency of a v.m. valve at 9 360 Mc/s is stabilized by comparison with a crystal, giving short-term stability, relative to the crystal, of the order of ± 100 c/s.

621.396.615.142.2 **2105**

Valves for Communication on Frequencies above 1 000 Mc/s: Part 1.—H. Schnitger. (*Fernmeldetech. Z.*, Feb. 1949, Vol. 2, No. 2, pp. 51–56.) A general outline of the principles of klystrons of the normal and the reflex type, with a short account and illustration of the 2-chamber klystron of the German Post Office; this gives an output of 100 W on a wavelength of 9 cm.

621.396.645 : 537.311.33 : 621.315.59 **2106**

Germanium — Important New Semiconductor.—Dunlap. (*See* 1968.)

621.396.645 : 537.311.33 : 621.315.59 **2107**

Some Novel Circuits for the Three-Terminal Semiconductor Amplifier.—Webster, Eberhard & Barton. (*See* 1905.)

621.396.645 : 537.311.33 : 621.315.59 **2108**

The Double-Surface Transistor.—J. N. Shive. (*Phys. Rev.*, 15th Feb. 1949, Vol. 75, No. 4, pp. 689–690.) Emitter and collector point-contacts bear on opposite faces of a thin wedge of Ge and a third contact of larger area is provided on the base of the wedge. Separation between the points should not exceed 0.1 mm. Families of curves are given which facilitate correct choice of the d.c. operating voltage and give complete information for determining the dynamic input and output impedances and the forward and backward transfer impedances about any selected operating point. An explanation of the action of this type of transistor is given. See also 913 of March (White) and back references and 2109 below.

621.396.645 : 537.311.33 : 621.315.59 **2109**

Investigation of Hole Injection in Transistor Action.—J. R. Haynes & W. Shockley. (*Phys. Rev.*, 15th Feb. 1949, Vol. 75, No. 4, p. 691.) The impedance changes at the collector point of a transistor were investigated by applying an intermittent potential to multiple emitter points and observing the resulting probe-current variations. The results are explained in terms of the movement of positive particles with a mobility of about 1.2×10^3 cm/sec per V/cm.

621.383 **2110**

Photoelectric Cells in Industry. [Book Review]—R. C. Walker. Pitman & Sons, London, 501 pp., 40s. (*Electronic Engng*, Feb. 1949, Vol. 21, No. 252, p. 68.) Typical uses of such cells are discussed from the point of view of the practical man whose purpose is to use electrons rather than theorize about them.

MISCELLANEOUS

621.39 **2111**

What the S.C.E.L. [Signal Corps Engineering Laboratories] **is Doing.**—H. A. Zahl. (*FM-TV*, Feb. 1949, Vol. 9, No. 2, pp. 13–22.) A general survey of work in many fields. Development work is the primary task, but basic and applied research work related to the military effort is also undertaken.

621.396 **2112**

Radio Progress during 1948.—(*Proc. Inst. Radio Engrs, W. & E.*, March 1949, Vol. 37, No. 3, pp. 286–322.) A general review with a bibliography of 855 references.

621.396 Popov **2113**

Alexander S. Popov.—J. B. Thornton. (*Wireless Engr*, April 1949, Vol. 26, No. 307, pp. 141–142.) Comment on 1842 of 1948 (G.W.O.H.).

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

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ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 **2114**

References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, May 1949, Vol. 21, No. 3, pp. 273–280.) Continuation of 924 of April.

534 : 061.3 **2115**

A Report on the International Conference on Acoustics, London, 1948.—L. L. Beranek. (*J. acoust. Soc. Amer.*, May 1949, Vol. 21, No. 3, pp. 264–269.)

534.143 : 538.652 **2116**

Motional Impedance Measurements on a Magnetostrictive System.—F. P. Finlon. (*J. acoust. Soc. Amer.*, May 1949, Vol. 21, No. 3, pp. 177–182.) Describes a method of mounting a nickel toroid coil in a block of Permafil, a nonmagnetic plastic, so that motion due to magnetostriction can be damped out. The motional impedance can then be obtained as the difference between the clamped and unclamped impedances. Frequency range, 5–45 kc/s.

534.21 **2117**

Interactions between a Plate and a Sound Field.—R. D. Fay. (*J. acoust. Soc. Amer.*, May 1949, Vol. 21, No. 3, p. 272.) Corrections to 605 of March.

534.22-13 + 534.231.3-13] : 534.321.9 **2118**

Ultrasonic Velocities and Absorption in Gases at Low Pressures.—I. F. Zartman. (*J. acoust. Soc. Amer.*, May 1949, Vol. 21, No. 3, pp. 171–174.) Improvements in an interferometer of the Hubbard type (1932 Abstracts, p. 171) are described and measurements of velocity and absorption in air, CO_2, H_2 and N_2 are given for frequencies from 500 kc/s to 2.16 Mc/s, temperatures from 9°C to 36.6°C and pressures from 82.17 cm Hg to 0.45 cm Hg.

534.321.9 **2119**

Visual Methods for Studying Ultrasonic Phenomena.—R. B. Barnes & C. J. Burton. (*J. appl. Phys.*, March 1949, Vol. 20, No. 3, pp. 286–294.) A brief review of the applications and methods of schlieren photography. A simple technique is described, with many photographs of the reflection and diffraction of ultrasonic waves in liquids.

534.7 : 611.85 **2120**

The Structure of the Middle Ear and the Hearing of One's Own Voice by Bone Conduction.—G. v. Békésy. (*J. acoust. Soc. Amer.*, May 1949, Vol. 21, No. 3, pp. 217–232.) A detailed discussion of the construction of the animal ear and throat as an acoustic system shows how the ear's sensitivity is not upset by sounds originating in the throat.

534.7 : 611.85 **2121**

The Vibration of the Cochlear Partition in Anatomical Preparations and in Models of the Inner Ear.—G. v. Békésy. (*J. acoust. Soc. Amer.*, May 1949, Vol. 21, No. 3, pp. 233–245.) Translation of an article published in *Akust. Z.*, 1942, Vol. 7, pp. 173–186. An account of experimental methods (acoustic and optical) by which the vibrations of the round window (cochlear partition) were studied. A working model of the cochlea is described.

534.7 : 611.85 **2122**

On the Resonance Curve and the Decay Period at Various Points on the Cochlear Partition.—G. v. Békésy. (*J. acoust. Soc. Amer.*, May 1949, Vol. 21, No. 3, pp. 245–254.) Translation of an article published in *Akust. Z.*, 1943, Vol. 8, pp. 66–76.

534.833 **2123**

Absorption by Sound-Absorbent Spheres.—R. K. Cook & P. Chrzanowski. (*J. acoust. Soc. Amer.*, May 1949, Vol. 21, No. 3, pp. 167–170.) Theory and measurement show that the absorption coefficient of a sphere covered with hair felt can be greater than unity. The normal impedance assumption does not appear to be valid.

534.842 **2124**

Concert Hall Acoustics.—P. H. Parkin. (*Nature, Lond.*, 22nd Jan. 1949, Vol. 163, No. 4134, pp. 122–124.) Report of Physical Society discussion.

534.86 : 534.322.1 **2125**

Influence of Reproducing System on Tonal-Range Preferences.—H. A. Chinn & P. Eisenberg. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, pp. 401–402.) Discussion on 2695 of 1948.

534.861.1 + 534.862.1 **2126**

A Demonstration Studio for Sound Recording and Reproduction and for Sound Film Projection.—(*Philips tech. Rev.*, Jan. 1949, Vol. 10, No. 7, pp. 196–204.) Description of the construction and special features of a new studio at Eindhoven. The reverberation time at the higher frequencies (0.9 sec at 2 000 c/s) is only slightly less than at the lower frequencies (1.3 sec at 100 c/s); this has a good effect on high-note response.

621.395.61 **2127**

The Miniature Electrodynamic Microphone of the Société indépendante de T.S.F.—(*Ann. Radioélect.*, April 1949, Vol. 4, No. 16, pp. 161–163.) A short description of Type S.I.F. MD. 8, which is 30 mm in diameter, 18 mm thick and weighs 30 gm. Response is linear to within ±7.5 db in the frequency band 300–6 000 c/s and signal/noise ratio and sensitivity are good. Impedance is $70\ \Omega \pm 10\%$ at 1 000 c/s.

621.395.61 + 681.85] : 621.315.612.4 **2128**

Application of Activated Ceramics to Transducers.—H. W. Koren. (*J. acoust. Soc. Amer.*, May 1949, Vol. 21, No. 3, pp. 198–201.) The conditions are examined under which titanate ceramics can be made to have pronounced piezoelectric properties. Methods of applying the necessary stress to ceramic strips are described. Various applications are mentioned, including a sensitive gramophone pickup.

621.395.61 : 534.773 **2129**

Interactions between Microphones, Couplers and Earphones.—K. C. Morrical, J. L. Glaser & R. W. Benson. (*J. acoust. Soc. Amer.*, May 1949, Vol. 21, No. 3, pp. 190–197.)

621.395.61 : 621.317.32 **2130**

The Substitution Method of Measuring the Open Circuit Voltage Generated by a Microphone.—M. S. Hawley. (*J. acoust. Soc. Amer.*, May 1949, Vol. 21, No. 3, pp. 183–189.) Analysis shows that the 'normal' substitution voltage equals the open-circuit voltage for all types of acoustic measurement and for any value of the electrical impedance loading the microphone.

621.395.625.2 **2131**

The Design of a Balanced-Armature Cutter-Head for Lateral-Cut Disc Recording.—F. E. Williams. (*Proc. Instn elect. Engrs*, Part III, March 1949, Vol. 96, No. 40, pp. 145–158.) The theory of cutter heads is developed with particular reference to the control of mechanical resonance by inertia, stiffness and damping. Moving-coil and moving-iron systems are considered. The limitations set by the magnetic circuit make it impracticable to obtain modulation velocities of the order of 15 cm/s at 400 c/s unless the fundamental resonance frequency of the mechanical system is made less than 3 000 c/s.

621.395.625.3 : 534.76 **2132**

A Stereophonic Magnetic Recorder.—M. Camras. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, pp. 442–447.) An experimental 3-channel recorder and play-back unit is described and results obtained with it are discussed. Best results for a small room are obtained with a dihedral mounting of two loudspeakers.

621.395.625.3 **2133**

Graphical Analysis of Linear Magnetic Recording using High-Frequency Excitation.—M. Camras. (*Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, pp. 569–573.) "The addition of a high-frequency component to an audio signal which is to be recorded magnetically results in a low-distortion, linear recording characteristic under certain conditions. This paper gives a graphical method for constructing the recording characteristic from the B_R versus H curve of the record material. An analysis accounts for such magnetic-recording characteristics as variation in sensitivity with bias, linearity at low recording levels, adjustment for maximum sensitivity, and adjustment for minimum distortion."

621.395.665.1 **2134**

Contrast Expansion.—Wheeler. (*See* 2171.)

621.395.813 : 621.395.623.7 **2135**

Non-Linear Distortion in Dynamic Loudspeakers due to Magnetic Effects.—W. J. Cunningham. (*J. acoust. Soc. Amer.*, May 1949, Vol. 21, No. 3, pp. 202–207.) An analysis of two kinds of distortion; that due to (*a*) the force between the voice coil and the magnet iron, and (*b*) the non-uniformity of the magnetic field. Distortion produced may be several tenths of 1%. To minimize (*b*), the voice coil and the magnet gap should have unequal lengths.

621.396.611.21 : 534.6 **2136**

Low Loss Crystal Systems.—W. J. Fry. (*J. acoust. Soc. Amer.*, May 1949, Vol. 21, No. 3, p. 272.) Corrections to 1326 of May.

AERIALS AND TRANSMISSION LINES

621.315.2 **2137**

High-Impedance Cable.—S. Frankel. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, p. 406.) An approximate expression for the inductance of a long solenoid surrounded by a cylindrical shield is derived by consideration of the multi-wire transmission line obtained when coil and shield are cut lengthwise and unwrapped. Results obtained appear to confirm the value of the correction coefficient given by Winkler. The formula obtained for the distributed capacitance of the system agrees with that for a coaxial line. See also 1278 of May (Hodelin).

621.315.212 **2138**

Influence of Nonuniformity in a Coaxial Cable on its Parameters.—L. A. Zhekulin. (*Bull. Acad. Sci. U.R.S.S. tech. Sci.*, Sept. 1947, No. 9, pp. 1089–1105. In Russian.)

621.392.26† **2139**

Disk-Loaded Wave Guides.—E. L. Chu & W. W. Hansen. (*J. appl. Phys.*, March 1949, Vol. 20, No. 3, pp. 280–285.) Dimensions of such waveguides for use in a linear accelerator are calculated with high accuracy by Schwinger's method, of which a qualitative explanation is given. Comparison with the work of J. C. Slater (M.I.T. Technical Report No. 48, 19th Sept. 1947) shows perfect agreement.

621.392.26† **2140**

Geometrical Representation of the Characteristics of an Active Obstacle inserted in a Waveguide.—J. Ortusi & P. Fechner. (*Ann. Radioélect.*, April 1949, Vol. 4, No. 16, pp. 131–135.) In waveguide problems it is often necessary to consider the reflections caused by impedances thrown back into the main waveguide by shunt or series matching stubs, which may be variable. A simple geometrical method is described for determining the coefficients of reflection, transmission and energy loss corresponding to such impedances and, conversely, for determining the impedance from measured values of the coefficients. The shunt and series cases are considered separately.

621.392.26† : 621.3.09 **2141**

The Conditions of Propagation of H_0 Waves, and their Applications.—J. Ortusi. (*Ann. Radioélect.*, April 1949, Vol. 4, No. 16, pp. 95–116.) H_0 waves are defined as those for which the longitudinal current in the waveguide wall is everywhere zero. Discussion of : (*a*) mathematical theory for such waves in waveguides of circular section, (*b*) methods of producing them practically free from parasites, (*c*) filters of various types favouring the propagation of H_0 waves, (*d*) measurement methods, (*e*) attenuation, (*f*) the effects of waveguide deformation or curvature and of the dielectric filling the waveguide, (*g*) curves showing the attenuation in circular waveguides compared with that for propagation in the open air by diffraction, (*h*) applications to the construction of cavity wavemeters with very high Q and to problems connected with radar scanning.

621.396.67 **2142**

Antennas for Circular Polarization.—W. Sichak & S. Milazzo. (*Elect. Commun.*, March 1949, Vol. 26, No. 1, pp. 40–45.) Reprint of 3343 of 1948.

621.396.67 **2143**

U.H.F. Aerials.—J. Maillard. (*Onde élect.*, March 1949, Vol. 29, No. 264, pp. 110–123.) The general characteristics of aerial radiation are outlined and the special features of u.h.f. aerials are considered. Various types are described and their use for particular services is discussed.

621.396.67 : 538.56 : 535.13 **2144**

The Radiation and Transmission Properties of a Pair of Parallel Plates : Part 2.—A. E. Heins. (*Quart. appl. Math.*, Oct. 1948, Vol. 6, No. 3, pp. 215–220.) Formulae are derived for the reflection coefficient at the mouth of a semi-infinite parallel-plate system excited by a plane wave. Fields are expressed by integral equations of the Wiener-Hopf type and the Fourier transforms are determined. Part 1, 1920 of July.

621.396.67 : 621.396.41 : 621.396.65 **2145**

Use of a Reflecting Mirror and of Simple Electromagnetic Lenses for the Experimental 23-cm Link between France and Corsica.—J. Hugon. (*Ann. Radioélect.*, April 1949, Vol. 4, No. 16, pp. 157–160.) Communication could be effected by a link with direct visibility between Mont Agel and Calenzana or between Grasse and Calenzana (*a*) directly, with part of the path beyond optical range, or (*b*) indirectly, using a reflector installed on Monte Grosso (Corsica), with direct visibility to Grasse and oriented so as to reflect signals from Grasse to the receiving aerial at Calenzana, or vice versa. The reflector was of perforated sheet-iron and had an aperture of 10 × 4 m. Tests showed that it gave a gain of 20 db compared to the direct link beyond optical range. The e.m. lenses used with the Mont Agel transmitter had rectangular waveguides, of dimensions decreasing from centre to sides, fitted along the top and bottom. The propagation velocities in these waveguides were so calculated as to correct the phase shifts in the aperture plane and to give an effective plane wave output, resulting in improved directional characteristics. See also 3508 of 1948 (Rivère).

621.396.671 : 621.396.97 **2146**

Directional Antennas for A.M. Broadcasting.—J. H. Battison. (*Electronics*, April 1949, Vol. 22, No. 4, pp. 101–103.) A simplified, practical method of calculating radiation patterns for 2-tower and 3-tower arrays.

621.396.677 **2147**

Analysis of the Metal-Strip Delay Structure for Microwave Lenses.—S. B. Cohn. (*J. appl. Phys.*, March 1949, Vol. 20, No. 3, pp. 257–262.) See also 2176 of 1948 (Kock).

621.396.677 **2148**

Aerial Arrays with Horizontal Beams without Side Lobes.—O. Schmidl. (*Bull. schweiz. elektrotech. Ver.*, 11th Jan. 1947, Vol. 38, No. 1, pp. 15–20. In German, with French summary.) General theory is developed by considering the resultant obtained by superposition of the radiation distributions from each element. Technical requirements demand a minimum number of such elements with optimum efficiency. Practical design formulae are derived and applied in two numerical examples.

CIRCUITS AND CIRCUIT ELEMENTS

538.1 : 621.392.26† : 621.396.611.4 **2149**

Narrow Gaps in Microwave Problems.—W. R. Smythe. (*Rev. mod. Phys.*, Jan. 1948, Vol. 20, No. 1, pp. 175–180.) An explicit expression, $E_x = f(x)$, is given for the x-component of the electric field between two infinite, oppositely charged conducting masses bounded by the $y = 0$, $x = b$ planes and the $y = 0$, $x = -b$ planes, respectively. The coefficients of the Fourier expansion of E_x and the potential function V are used to determine a rapidly convergent series for the potential in the narrow gap between two right circular, coaxial, conducting cylindrical electrodes. The resonance frequency of a re-entrant cylindrical cavity with a narrow gap is computed within about 0.03%. The shape of the field radiated from the open end of a rectangular waveguide, terminating in an infinite conducting plane and transmitting only the TE_{10} mode, is calculated with 4-figure accuracy.

621.3.012.2 : 621.392.5 **2150**

Circle Diagrams of Impedance or Admittance for Four-Terminal Networks.—J. Rybner. (*Proc. Instn elect. Engrs*, Part III, March 1949, Vol. 96, No. 40, p. 132.) Discussion on 3357 of 1948.

621.3.012.8 : 621.385.2 **2151**

Diode Circuit Analysis.—R. H. Dishington. (*Elect. Engng, N.Y.*, Nov. 1948, Vol. 67, No. 11, pp. 1043–1049.) The nonlinear valve characteristic is analysed and an equivalent circuit is suggested to which most ordinary applications can be reduced. This method of analysis is less complex than other methods hitherto used and can be applied to various diode and multi-element valve circuits, such as the diode modulator.

621.3.012.8 : 621.385.2 : 518.4 **2152**

Graphical Analysis of Diode Circuits.—G. L. Hamburger. (*Wireless Engr*, May 1949, Vol. 26, No. 308, pp. 147–153.) Analysis of the basic diode-rectifier circuit leads to an integral equation which has no formal explicit solution ; it can, however, be solved by a simple graphical method which is applicable to periodic input voltages of arbitrary waveform. The method is applied to a typical a.m. detector, and to squaring and clipping circuits. Circuits involving reactance are briefly considered.

621.314.2 **2153**

Design of I.F. Transformers.—B. Sandel. (*Radiotronics*, May/June 1948, No. 131, pp. 43–59.) Design procedure can be reduced to a few routine operations with the aid of charts and tables if certain assumptions are made. Only the 2-winding transformer with mutual-inductance coupling is here considered; the added capacitance coupling is taken into account by adjusting the coefficient of coupling k. Numerical examples are included. F.m. transformers are discussed as well as undercoupled, overcoupled and critically-coupled transformers. Practical construction details and methods of measuring k are also considered.

621.314.2.015.33 **2154**

Considerations on Pulse Transformers.—F. Blaché. (*Ann. Radioélect.*, April 1949, Vol. 4, No. 16, pp. 149–156.) Simple calculation and design methods are presented for transformers of high power. The methods are based on the response to an ideal rectangular pulse. The effects of the various transformer constants on the pulse shape are shown graphically, and methods of measuring primary inductance, core permeability and losses are indicated.

621.316.718 : 621.396.9 : 371.3 **2155**

The Velodyne.—F. C. Williams & A. M. Uttley. (*Proc. Instn elect. Engrs*, Part III, March 1949, Vol. 96, No. 40, p. 168.) Discussion on 962 of 1948.

621.316.86 **2156**

Thermistors.—F. E. Butler. (*Radio News, Radio-Electronic Engng Supplement*, May & June 1948, Vol. 10, Nos. 5 & 6, pp. 15–18, 31 & 10–12, 30.) Detailed discussion of their properties and applications. Materials used are oxides of Mn, Ni, Co, Cu, U etc. Resistance can be varied by several powers of 10 by introducing impurities or by other treatment. Manufacturing methods are discussed. Applications considered include compensation of resistance changes, automatic control, timing devices and voltage regulators.

621.318.423.011.3(083.3) **2157**

The Use of Bessel Functions for Calculating the Self-Inductance of Single-Layer Solenoids.—E. B. Moullin. (*Proc. Instn elect. Engrs*, Part III, March 1949, Vol. 96, No. 40, pp. 133–137.) Continuation of 2077 of 1947. The general Bessel formulae lead to the well-known expression for the field at the centre of a solenoid. The Bessel treatment has special advantages for calculating the field just inside the winding. Formulae are derived for the inductance of an isolated solenoid and also of a solenoid symmetrically placed between two infinite metal sheets perpendicular to its axis.

621.318.423.011.3(083.3) **2158**

A Note on the Inductance of Screened Single-Layer Solenoids.—F. M. Phillips. (*Proc. Instn elect. Engrs*, Part III, March 1949, Vol. 96, No. 40, pp. 138–140.) The change of inductance which occurs when a single-layer solenoid is placed inside a coaxial cylindrical screening can is calculated by Moullin's method (2157 above) and compared with that obtained from Bogle's empirical formulae (821 of 1941).

621.318.572 **2159**

Scaler Circuits.—W. M. Couch, Jr. (*Radio News, Radio-Electronic Engng Supplement*, June & Aug. 1948, Vol. 10, No. 6, pp. 3–5 . . 28 & Vol. 11, No. 2, pp. 10–12 . . 30.) Comparison of (*a*) trigger-type circuits, with special reference to the Eccles-Jordan binary-scale unit, (*b*) ring circuits, and (*c*) capacitor accumulation circuits, and discussion of their design and operation. A bibliography of 47 references is included.

621.318.572 **2160**

High-Speed Trigger Circuit.—W. B. Lurie. (*Electronics*, April 1949, Vol. 22, No. 4, pp. 85–87.) For photographic and other applications which require triggering pulses in a predetermined time pattern after a given event (sound, flash of light, etc.). The event is used to generate a keying pulse which, after inversion and clipping, is applied to three delay lines, with independent delays ranging up to 26.6 μs, to derive positive high-level firing pulses. The undelayed pulse is also applied, after shaping and clipping, to a thyratron generator to produce a pulse of square form with a maximum current of 10 A through 1 Ω.

621.319.4 **2161**

Resonances in Capacitors.—C. F. Muckenhoupt. (*Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, pp. 532–533.) In a parallel-plate capacitor whose leads emerge at opposite ends, the higher resonance and antiresonance frequencies are very close together; near such points the capacitor may be very frequency-sensitive and exhibit anomalous effects.

621.319.4 **2162**

Ceramic Capacitors.—W. G. Roberts. (*J. Brit. Instn Radio Engrs*, May 1949, Vol. 9, No. 5, pp. 184–199. Discussion, pp. 199–200.) A general survey. Properties of the various types of material, and the construction, manufacture and uses of the capacitors are discussed.

621.392 **2163**

Transfer Functions for R-C and R-L Equalizer Networks.—E. W. Tschudi. (*Electronics*, May 1949, Vol. 22, No. 5, pp. 116–120.) Transfer functions and gain-curve asymptotes are shown for 30 different types of network.

621.392 : 003.62 **2164**

Drawing Circuit Diagrams. — L. Bainbridge-Bell. (*Wireless World*, May 1949, Vol. 55, No. 5, pp. 179–180.) Discussion of representation of leads which cross without connection. See also 664 of March.

621.392 : 621.3.015.3 **2165**

The Effect of Pole and Zero Locations on the Transient Response of Linear Dynamic Systems.—J. H. Mulligan. (*Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, pp. 516–529.) The conditions for a monotonic time response are expressed in terms of the location of transfer-function poles and zeros, for stable low-pass systems having only first-order poles and no poles on the $j\omega$ axis. A simplified method of computing maxima and minima in the time response is explained. Under certain conditions the normalized time response is well represented by a single dominant time term. A method of determining whether these conditions exist is discussed. When they do exist, a method is outlined for designing pole and zero patterns to yield given time-response characteristics of a certain kind for step-function inputs. Constant overshoot-factor curves and charts are provided for this purpose. The results can be applied to networks, amplifiers, servomechanisms, etc.

621.392 : 621.3.015.3 **2166**

Transient Response Equalization through Steady-State Methods.—W. J. Kessler. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, pp. 447–450.) Only a sinusoidal signal generator and a c.r.o. are used. The frequency of the signal generator is slowly swept through the transmission ranges of the networks, and amplitude and phase adjustments are made so that a closed line of unit slope is displayed on the c.r.o. at all frequencies. Photographs of patterns displayed on the c.r.o. and methods of determining the required network adjustments rapidly are discussed.

621.392.5 **2167**

The "Phantastron" Control Circuit.—J. R. McDade. (*Elect. Engng, N.Y.*, Oct. 1948, Vol. 67, No. 10, pp. 974–977.) The construction and operation of the pentagrid converter valve used in these radar delay circuits are described. The action of a typical phantastron circuit is explained in detail by considering separately the six periods corresponding to the discontinuous portions of the voltage waveform. For another account see 2478 of 1948 (Close & Lebenbaum).

621.392.5 : 621.385.3 : 512.831 **2168**

The Application of Matrices to Vacuum-Tube Circuits.—J. S. Brown & F. D. Bennett. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, pp. 403–404.) Discussion on 3043 of 1948.

621.392.5.029.64 : 621.392.26† **2169**

A Consideration of Directivity in Waveguide Directional Couplers.—S. Rosen & J. T. Bangert. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, pp. 393–401.) 1947 I.R.E. National Convention paper. An explanation of the behaviour of a two-hole coupler is given in terms of an infinity of interaction processes between two waveguides. Expressions based on Bethe's theory are derived for the directivity ratio in terms of the transmission factor and the distance between the holes. Solutions are also obtained for two and for four pairs of holes. The directivity ratio usually reaches a non-zero minimum for a single pair of holes, and has multiple minima, one of which is almost independent of pair-spacing, for the multiple-pair systems. Comparison with experiment shows good agreement for transmission factors up to 0.01. See also 675 of 1948 (Riblet).

621.392.52 **2170**

Resonant-Section Band-Pass Filters.—S. Frankel. (*Elect. Commun.*, March 1949, Vol. 26, No. 1, pp. 76–83.) An explicit formula is obtained for the ratio η of the power transferred to the resistive load to the maximum power transferable under matched conditions; the filter is assumed to consist of a chain of n identical resonators coupled by identical reactances to the preceding and following resonators. When $n = 10$, η is constant within 3 db over 85% of the pass band, but has undesirable fluctuations at the edges of the band.

621.395.665.1 **2171**

Contrast Expansion.—L. J. Wheeler. (*Wireless World*, June 1949, Vol. 55, No. 6, pp. 211–215.) A review of different methods and of means for eliminating their defects. Circuit diagrams of several systems are given, including a modified negative-feedback circuit giving improved results in reproduction from gramophone records.

621.396.61 **2172**

Parasitic Oscillations.—"Cathode Ray". (*Wireless World*, June 1949, Vol. 55, No. 6, pp. 206–210.) Discussion of conditions favourable to the production of unwanted oscillations and of means of preventing them.

621.396.611.21 **2173**

Cathode-Coupled Crystal Oscillators.—F. Butler. (*Short Wave Mag.*, June 1949, Vol. 7, No. 4, pp. 258–262.) Simple explanations are given of the operation of the basic circuit (32 of 1945) and of the derivatives described by Goldberg & Crosby (333 of February and 3048 of 1948).

621.396.611.3 : 621.365.5 **2174**

On Circuits with Electromagnetic Coupling and their Application in H.F. Induction-Heating Equipment.—F. P. Pietermaat. (*HF, Brussels*, 1949, No. 2, pp. 35–44. In French.) The importance of a knowledge of the Q factor of the oscillatory circuit of an oscillator used for h.f. induction heating is stressed. The case is considered where the oscillatory circuit and the work are coupled by means of an aperiodic transformer. Abacs are given which enable Q to be determined rapidly. The effect of partial tuning of the work coil is examined and also the case where only a part of the oscillatory circuit inductance is coupled to the work coil. Numerical examples are included.

621.396.615 **2175**

Generation of Oscillations.—R. Urtel; F. W. Gundlach; J. Frey; W. O. Schumann; E. Marx; G. Hettner. (*FIAT Review of German Science 1939–1946. Electronics, incl. Fundamental Emission Phenomena*, Part 1, 1948, pp. 147–250. In German.)

Sections 1, 2 & 3, by Urtel, briefly consider (*a*) general questions and stability, (*b*) feedback, and (*c*) kipp oscillations.

Section 4, by Gundlach, gives a full account of theoretical and experimental work in Germany in connection with transit-time valves for u.h.f. work, including diodes, retarding-field valves, valves with space-charge or velocity control, and magnetrons.

Section 5, by Frey, outlines work on frequency multiplication.

Section 6, by Schumann, discusses plasma oscillations.

Section 7, by Marx, deals briefly with spark transmitters for centimetre waves.

Section 8, by Hettner, discusses the production of waves in the range 0.1–0.3 mm with the high-pressure Hg-vapour lamp.

621.396.615 **2176**

Oscillation Amplitude in Simple Valve Oscillators.—A. S. Gladwin. (*Wireless Engr*, May & June 1949, Vol. 26, Nos. 308 & 309, pp. 159–170 & 201–209.) A method is derived of calculating this amplitude in oscillators of the regenerative type where grid-leak bias is used. The amplitude is found in terms of parameters which are functions of the valve and circuit constants, and the solution is presented graphically.

Two types of amplitude instability are studied and criteria for their existence are deduced. The first type is dynamical instability or squegging; the second type gives rise to the effect known as oscillation hysteresis.

The analysis is applicable to all the common types of oscillator circuit, subject to the conditions that the valve should operate always in the space-charge-limited condition, and that the anode voltage should never fall to the point where the anode current is rapidly diverted to the grid or screen.

621.396.615 **2177**

Wide-Range Deviable Oscillator.—M. E. Ames. (*Electronics*, May 1949, Vol. 22, No. 5, pp. 96–100.) A cathode follower working into a capacitive load will produce a phase shift dependent on the anode a.c. resistance, which in turn depends on the grid bias. The type of oscillator described uses four such phase-shift stages following an amplifier. The system oscillates at the frequency for which the phase shift per stage is 45° and this shift is effected by making the capacitive reactance of each stage equal to its equivalent resistance. F.m. is accomplished by simultaneous variation of the anode current of all the four phase-shift stages. Each time the effective resistance is altered by changing the grid bias, the oscillation frequency changes to a new value at which the reactance of the fixed capacitors is equal to the new effective resistance. The voltage loss of the phase-shift stages remains constant because the amplification factor of the triodes does not change and because the phase-shift required is also constant. With careful design, a linear frequency/modulating-voltage characteristic is obtained. One oscillator constructed has a frequency range from 150 c/s to 15 kc/s; frequencies as high as 40 Mc/s can be attained by using high-transconductance miniature triodes.

621.396.615 : 621.396.619.13 **2178**

A Simple Method of Producing Wide-Band Frequency Modulation.—Rakshit & Sarkar. (*See* 2362.)

621.396.615.17 **2179**

Blocking Oscillators.—W. T. Cocking. (*Wireless World*, June 1949, Vol. 55, No. 6, pp. 230–233.) A method is described for improving the linearity of the sawtooth output by eliminating the h.f. transients superimposed on the wave at the commencement of each stroke. This enables the circuit to be used as an oscilloscope timebase at higher repetition frequencies than are usually possible with this type of oscillator. Circuit diagrams are given.

621.396.615.17 **2180**

Pulse Generation.—S. Moskowitz & J. Racker. (*Radio News, Radio-Electronic Engng Supplement*, July 1948, Vol. 11, No. 1, pp. 14–19..30.) Discussion of circuits and techniques. Both active and passive networks are considered.

621.396.615.17 **2181**

Symmetrical Multivibrators.—R. Feinberg. (*Wireless Engr*, May 1949, Vol. 26, No. 308, pp. 153–158.) "Formulae are derived from an equivalent circuit diagram to give the frequency and waveform of oscillation of a symmetrical multivibrator circuit with pentodes operating on the coalescent part of their characteristic; it is assumed that the interelectrode capacitances of the valves and any self-inductances and self-capacitances of the circuit elements have no effect on the circuit performance. The waveform of oscillation is rectangular when the time-constant of capacitor charge is relatively small, and is triangular when the time-constant is relatively large. The frequency is governed by the d.c. supply voltage, the type and screen-grid voltage of the pentodes and essentially by the values of the reservoir capacitance and the grid-shunting resistance. Predicted frequencies and waveforms are verified by experiment."

621.396.619.13 **2182**

Frequency Swing with Variable-Reactance Valves.—R. Leprêtre. (*Onde élect.*, March & April 1949, Vol. 29, Nos. 264 & 265, pp. 130–136 & 167–174.) The equivalent impedance of a reactance valve and its RC circuit, when R is connected between grid and anode, is shown theoretically to be inductive. Formulae are derived, in a manner as rigorous as possible, for the frequency swing and the damping. An approximate equation for the reactive admittance is given for the general case and for a pentode, with a simplified formula for the frequency swing and with numerical examples. When C is connected between grid and anode the equivalent impedance is capacitive. Comparison shows that the capacitive arrangement gives a greater frequency swing for a given damping than the inductive connection. Circuits in which the damping is zero, or even negative, are discussed, with particular reference to a circuit described by Helfrich (2489 of 1948). A circuit insensitive to supply-voltage variations is also given.

621.396.619.23 **2183**

The Serrasoid F.M. Modulator.—Day. (*See* 2363.)

621.396.619.23 **2184**

Non-Linear Effects in Ring Modulators.—V. Belevitch. (*Wireless Engr*, May 1949, Vol. 26, No. 308, p. 177.) The operation of a 4-rectifier ring modulator is considered for signal voltages of arbitrary value, and the amplitude of the general modulation product is given as a hypergeometric function. Curves are drawn for the lowest products, illustrating the departure from linearity with increasing signal voltage.

621.396.619.23 : 621.396.615.17 **2185**

A Modulator Producing Pulses of 10^{-7} Second Duration at a 1-Mc/s Recurrence Frequency.—M. G. Morgan. (*Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, pp. 505–509.) A modulator for use with a spark transmitter, of pulse duration about 2×10^{-8} sec, for radar countermeasures. A large 1-Mc/s voltage wave is applied to the grid of a triode with low internal resistance and a sinusoidal 1-Mc/s signal is applied to the anode. Suitable phase adjustment results in the production of steep-fronted positive pulses which are applied to the grid of the modulator. The modulating voltage is built up across a capacitive load of 125 pF. The occurrence of a spark reduces the load impedance to a low value and assists in producing a rapid drop of the modulating voltage.

621.396.645 + 621.396.621.53 **2186**

Increase of Sensitivity of Amplifier and Mixer Stages for Metre and Decimetre Waves.—Strutt. (*See* 2312.)

621.396.645 **2187**

On the General Theory of Linear Amplifiers : Part 1.—S. P. Strelkov. (*Avtomatika i Telemekhanika*, May/June 1948, Vol. 9, No. 3, pp. 233–244. In Russian.) In a linear amplifier the input and output are related by a linear differential equation. A general analysis is given of the problem of finding such parameters of this equation as will ensure amplification without excessive distortion. Means of obtaining an approximate estimate of the distortion will be discussed in part 2.

621.396.645 **2188**

Note on the Sensitivity of an Amplifying Stage.—W. Kleen. (*Ann. Radioélect.*, April 1949, Vol. 4, No. 16, pp. 136–137.) Discussion of the grounded-anode circuit shows that at l.f. the sensitivity is the same whether cathode, grid or anode is grounded, though at h.f. the optimum sensitivity of the grounded-anode circuit differs slightly from that of the other two. See also 1338 of May.

621.396.645 **2189**

Amplification of Pulses by Gating Methods.—J. A. Fejer. (*Trans. S. Afr. Inst. elect. Engrs*, Feb. 1949, Vol. 40, Part 2, pp. 39–49. Discussion, pp. 49–50.) The limitations of conventional methods of pulse amplification are discussed, with reference to (*a*) the minimum pulse length for which amplification is possible, (*b*) ringing effects, and (*c*) internal noise. Three gating methods, whose principles are explained, all eliminate ringing and enable very short pulses to be amplified. Neglecting fluctuation noise in valves, the improvement in signal/noise ratio obtained by any of the three methods is equal to the ratio of pulse-recurrence frequency to the bandwidth of the amplifier following the gate. An experimental double-gate amplifier is described for which the measured signal/noise ratio showed an improvement of 31 db compared with the ratio for an amplifier not using gating technique. The application of gating technique to a.c. pulses is also considered and methods of locking to the leading edges of the d.c. modulating pulses are described.

621.396.645 **2190**

Stabilized Decade-Gain Isolation Amplifier.—J. F. Keithley. (*Electronics*, April 1949, Vol. 22, No. 4, pp. 98–100.) An input impedance of over 200 MΩ and less than 6 pF shunt capacitance is obtained by enclosing the input circuit in a shield which is at almost the same instantaneous potential as the test signal conductor. The low dynamic output impedance enables several measuring instruments to be connected to the amplifier in parallel, for simultaneous observation of various characteristics of signals in high-impedance circuits. See also 2281 of 1945 (Daniels).

621.396.645 **2191**

A Coaxial 50-kW F.M. Broadcast Amplifier.—Balthis. (*See* 2365.)

621.396.645 **2192**

Square-Wave Analysis of Compensated Amplifiers.—P. M. Seal. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, p. 382.) Correction to 1626 of June.

621.396.645 **2193**

Stagger-Tuned Amplifiers.—L. J. Libois. (*Onde élect.*, March 1949, Vol. 29, No. 264, pp. 124–129.) Formulae are derived which enable the number of stages and the values of the various circuit components to be calculated directly, without the use of abacs, for an amplifier with (*a*) the minimum number of valves, (*b*) a given gain, (*c*) as flat a response curve within the pass band as possible.

621.396.645.012.8 **2194**

Network Representation of Input and Output Admittances of Amplifiers.—L. M. Vallese. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, pp. 407–408.) A clear picture of circuit performance is obtained if these admittances are represented by networks derived from the equivalent circuit of the amplifier, together with certain series or parallel branches whose elements are functions of μ. Such networks are shown for grounded-cathode, grounded-grid and grounded-anode amplifiers and for reactance valves. Results are discussed.

621.396.645.37 **2195**

Combined Current and Voltage Feedback.—K. R. Sturley. (*Electronic Engng*, May 1949, Vol. 21, No. 255, pp. 159–161.) When voltage feedback is applied in the usual way, current feedback occurs simultaneously and cannot be ignored. The overall amplification and equivalent output impedance are here derived theoretically. Interaction between the sources of voltage and current feedback tends to reduce slightly the overall amplification.

621.396.645.371 **2196**

Negative Feedback Amplifiers.—T. S. McLeod. (*Wireless Engr*, May 1949, Vol. 26, No. 308, pp. 176–177.) Comment on 1910 of July (Brockelsby).

621.396.645.371 **2197**

When Negative Feedback isn't Negative.—"Cathode Ray". (*Wireless World*, May 1949, Vol. 55, No. 5, pp. 189–193.) Elementary discussion of the cause and prevention of oscillation and distortion.

621.396.69 + 621.317.7 + 621.38 **2198**

The Physical Society's Exhibition.—(*Engineering, Lond.*, 8th & 15th April 1949, Vol. 167, Nos. 4341 & 4342, pp. 313–316 & 337–340, 348; *Engineer, Lond.*, 8th, 15th & 22nd April 1949, Vol. 187, Nos. 4863–4865, pp. 382–385, 407–409 & 446–448; *Wireless World*, May 1949, Vol. 55, No. 5, pp. 182–186; *Wireless Engr*, May 1949, Vol. 26, No. 308, pp. 171–176.) Descriptions of selected exhibits.

621.396.69 **2199**

Recent Trends in Radio Technique.—M. Adam. (*Tech. mod., Paris*, 1st/15th May 1949, Vol. 41, Nos. 9/10, pp. 163–165.) Discussion of (*a*) miniaturization of all types of components, (*b*) the use of printed circuits in subminiature assemblies, (*c*) methods of ensuring satisfactory performance of equipment under extreme conditions of humidity, temperature and altitude, (*d*) component design to withstand shock, vibration, or rapid acceleration.

621.397.645.371 **2200**

Nonlinearity in Feedback Amplifiers.—A. B. Thomas. (*Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, p. 531.) Comment on 2766 of 1948 (Mulligan & Mautner).

GENERAL PHYSICS

534.21 + 538.566] : 537.228.1 **2201**

Wave Propagation in Piezoelectric Crystals.—J. J. Kyame. (*J. acoust. Soc. Amer.*, May 1949, Vol. 21, No. 3, pp. 159–167.)

535.37 **2202**

A Report on the Second Conference on Luminescence (held in Moscow, 12th–22nd May 1948).—(*Uspekhi Fiz. Nauk*, Dec. 1948, Vol. 36, No. 4, pp. 557–566. In Russian.)

535.37 **2203**

Polarized Luminescence.—P. P. Feofilov. (*Uspekhi Fiz. Nauk*, Dec. 1948, Vol. 36, No. 4, pp. 417–455. In Russian.)

537.291 + 538.691 **2204**

Some Properties of Tubular Electron Beams.—N. Wax. (*J. appl. Phys.*, March 1949, Vol. 20, No. 3, pp. 242–247.) Approximate expressions are obtained for the potential distribution, maximum current density, and spread of beams of finite thickness. Results are compared with those of Haeff (127 of 1940) and of Smith & Hartman (2409 of 1940).

537.533 + 621.385.83 **2205**

Electron Emission and Electron Currents.—H. Mayer; M. Knoll. (*FIAT Review of German Science 1939–1946. Electronics, incl. Fundamental Emission Phenomena*, Part 1, 1948, pp. 1–42. In German.) Section 1, by Mayer, reviews theoretical and experimental investigations on various aspects of the photoelectric effect. Section 2, by Knoll, in collaboration with E. Kinder, discusses electron optics, with particular reference to c.r.o. deflection systems, electron lenses and the electron microscope.

538.122 : 621.385 **2206**

An Electron Tube for Viewing Magnetic Fields.—Lutz & Tetenbaum. (*See* 2375.)

538.3 **2207**

Nonlinear Theories of the Electromagnetic Field.—F. Bertein. (*Rev. sci., Paris*, 1st April 1948, Vol. 86, No. 3294, pp. 349–356.) The difficulties presented by Maxwell's theory are reviewed, the principles of the Born-Infeld theory are outlined and brief reference is made to the theories of Dirac and L. de Broglie.

538.3 **2208**

Development in Series of the Retarded Potentials of Classical Electromagnetism.—É. Durand. (*J. Phys. Radium*, Feb. 1949, Vol. 10, No. 2, pp. 41–48.) One of the fundamental problems of classical electromagnetism is the calculation of the e.m. field produced by a given distribution of electricity variable in time. According as one adopts the hypothesis of a space-time distribution of electricity or the hypothesis of point charges, the solution of the problem is represented either by the integrals of retarded potentials or by the potentials of Liénard-Wiechert. The fields can then be easily deduced. These expressions cannot, in general, be used directly, since they involve the retard time, which cannot be expressed in terms of the usual analytical functions. Expressions are derived for the potentials as functions of actual time, using a new type of series development related to Lagrange series. Complete formulae are derived for the radiation potential of a linear sinusoidal oscillator and for the radiation field.

538.56 : 535.13 : 621.396.67 **2209**

The Radiation and Transmission Properties of a Pair of Parallel Plates: Part 2.—Heins. (*See* 2144.)

538.566 **2210**

A Note on Singularities occurring at Sharp Edges in Electromagnetic Diffraction Theory.—C. J. Bouwkamp. (*Physica, 's Grav.*, Oct. 1946, Vol. 12, No. 7, pp. 467–474. In English.) The existence of singularities is demonstrated explicitly in the case of Sommerfeld's well-known solution for diffraction at the edge of a perfectly conducting semi-plane. Möglich's solution for the 3-dimensional problem of diffraction by a circular screen is shown to be erroneous.

538.691 **2211**

Motion of an Electrified Particle in the Magnetic Field of a Current.—A. Brunel. (*Rev. sci., Paris*, 1st April 1948, Vol. 86, No. 3294, pp. 345–347.) Solutions are obtained for the motion of positively or negatively charged particles, with an initial velocity in any direction, in the field of a rectilinear current.

621.39.001.11 **2212**

Theoretical Limitations on the Rate of Transmission of Information.—Tuller. (*See* 2319.)

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.53 : 621.396.9 **2213**

A Phenomenological Theory of Radar Echoes from Meteors.—D. W. R. McKinley & P. M. Millman. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, pp. 364–375.) Echoes from meteors are classified into basic types according to their appearance on the range/time record of the radar display. These types include echoes indicating approach or recession, echoes of long duration and echoes with a complex structure. A qualitative explanation of the various types is given.

523.72.029.6 : 621.396.822 **2214**

Electromagnetic Solar Radiation on 158 Mc/s.—Y. Rocard. (*Rev. sci., Paris*, 1st April 1948, Vol. 86, No. 3294, p. 348.) A table is given of the solar energy radiated at this frequency, and the corresponding solar temperature, assuming the radiation to be of thermal origin, for various dates from 7th June to 7th July 1948. The records were obtained with a superheterodyne receiver, using a dipole aerial at the focus of a reflector 8 m in diameter, in open country 30 km south of Paris. The temperatures range from 4.4×10^5 to 8×10^5 degrees K.

523.72.029.64 : 621.396.822 **2215**

Circularly Polarized Solar Radiation on 10.7 Centimeters.—A. E. Covington. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, p. 407.) Radiation from the quiet sun appears to be randomly polarized, whereas sunspots can produce circularly polarized radiation. See also 2513 of 1948.

523.746 "1948.10/.12" **2216**

Provisional Sunspot-Numbers for October to December, 1948.—M. Waldmeier. (*J. geophys. Res.*, formerly *Terr. Magn. atmos. Elect.*, March 1949, Vol. 54, No. 1, p. 64.)

523.854 : 621.396.822 **2217**

Origin of the Radio Frequency Emission and Cosmic Radiation in the Milky Way.—A. Unsöld. (*Nature, Lond.*, 26th March 1949, Vol. 163, No. 4143, pp. 489–491.) The interpretation of galactic r.f. radiation as due to free-free transitions of electrons in the interstellar gas is unsatisfactory because (*a*) an electron temperature of 100 000–200 000°K is needed to account for results at 20–30 Mc/s, (*b*) the observed spatial distribution of the radiation does not fit. The alternative hypothesis is discussed that the radiation originates in late-type stars showing eruption activity like that of the sun, but on a scale perhaps 10^{11} times as great.

523.854 : 621.396.822 **2218**

Cosmic Radio Noise.—G. Reber. (*Radio News, Radio-Electronic Engng Supplement*, July 1948, Vol. 11, No. 1, pp. 3–5, 29.) Historical review, with discussion of intensity as a function of galactic longitude at zero galactic latitude and of apparatus used for measurement and recording.

538.12 : 521.15 **2219**

Rotation and Terrestrial Magnetism.—T. Gold. (*Nature, Lond.*, 2nd April 1949, Vol. 163, No. 4144, pp. 513–515.) Report of a geophysical discussion by the Royal Astronomical Society, 25th Feb. 1949, on the present state and observational justification of various theories.

550.38 "1948.07/.09" **2220**

Selected Days, Preliminary Mean *K*-Indices, and Preliminary *C*-Numbers for Third Quarter, 1948.—E. K. Weisman. (*J. geophys. Res.*, formerly *Terr. Magn. atmos. Elect.*, March 1949, Vol. 54, No. 1, pp. 66–67.)

550.38 "1948.10/.12" **2221**

Cheltenham [Maryland] ***K*-Indices for October to December, 1948.**—P. G. Ledig. (*J. geophys. Res.*, formerly *Terr. Magn. atmos. Elect.*, March 1949, Vol. 54, No. 1, p. 65.)

550.38 "1948.10/.12" **2222**

Daily Magnetic-Activity Figures *C*, Three-Hour-Range Indices *K*, and List of Sudden Commencements, October to December, 1948, at Abinger.—H. Spencer Jones. (*J. geophys. Res.*, formerly *Terr. Magn. atmos. Elect.*, March 1949, Vol. 54, No. 1, pp. 67–68.)

550.385 "1948.10/.12" **2223**

Principal Magnetic Storms [Oct.–Dec. 1948].—(*J. geophys. Res.*, formerly *Terr. Magn. atmos. Elect.*, March 1949, Vol. 54, No. 1, pp. 80–95.)

551.510.4 **2224**

The Vertical Distribution of Atomic Oxygen in the Upper Atmosphere.—R. Penndorf. (*J. geophys. Res.*, formerly *Terr. Magn. atmos. Elect.*, March 1949, Vol. 54, No. 1, pp. 7–38.)

551.510.52 **2225**

The Ionic Equilibrium of the Lower Atmosphere.—J. Bricard. (*J. geophys. Res.*, formerly *Terr. Magn. atmos. Elect.*, March 1949, Vol. 54, No. 1, pp. 39–52. In French, with English summary.)

551.510.535 **2226**

Measurement of Sporadic E-Layer Ionization.—K. Rawer. (*Nature, Lond.*, 2nd April 1949, Vol. 163, No. 4144, pp. 528–529.) The critical frequency is insufficient as a measure of sporadic E-layer ionization, because this layer consists of ionized clouds and is not homogeneous. At the Service Ionosphérique de la Marine Française (SPIM) station at Freiburg, the frequencies are observed for which the ratio of the strength of the sporadic-E reflection to the strength of the F-layer reflection has the values 100, 10, 1, 0.1 and 0.01. Results for August 1948 are shown graphically and discussed.

551.510.535 **2227**

On Long-Term Forecasts of the Critical Frequencies of the Ionosphere and of the Occurrence of Disturbances in it.—G. M. Bartenev. (*Bull. Acad. Sci. U.R.S.S. tech. Sci.*, Sept 1947, No. 9, pp. 1139–1152. In Russian.)

LOCATION AND AIDS TO NAVIGATION

621.396.9 **2228**

Spiral-Phase Fields.—E. K. Sandeman. (*Wireless Engr*, March 1949, Vol. 26, No. 306, pp. 96–105.) The general properties of such fields are examined theoretically. They are produced if four vertical aerials are placed at the corners of a horizontal square of side $<\lambda/4$, and each diagonal pair is driven in antiphase and in quadrature with the other diagonal pair. Three main applications are outlined: (*a*) an aircraft could obtain its bearing relative to the centre of the field, (*b*) a lighthouse or talking beacon could be operated so that continuous characteristic signals were sent out on various bearings, (*c*) narrow interrogating beams could be produced for secondary radar and possibly also for primary radar.

621.396.9 **2229**

Doppler Radar.—E. J. Barlow. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, pp. 340–355.) The principle of Doppler radar systems is that a frequency change is produced when radio waves are reflected from moving targets, which can thus be distinguished from stationary ones. The application of this principle to c.w. systems is described and compared with its use in pulse systems. Quantitative calculations are made of sensitivity, range error, fixed-target rejection and system stability.

621.396.9 : 371.3 **2230**

Aids to Training — The Design of Radar Synthetic Training Devices for the R.A.F.—G. W. A. Dummer. (*Proc. Instn elect. Engrs*, Part III, March 1949, Vol. 96, No. 40, pp. 101–112. Discussion, pp. 113–116.) The training devices described are of two main types, a bench trainer of simple design and a complete crew trainer. The former was required as an aid to the introduction of new radar systems, while the latter provided accurate presentation of moving targets, complete operational practice, and also error-recording facilities.

621.396.9 : 523.53 **2231**

A Phenomenological Theory of Radar Echoes from Meteors.—McKinley & Millman. (*See* 2213.)

621.396.93 **2232**

Some Relations between Speed of Indication, Bandwidth, and Signal-to-Random-Noise Ratio in Radio Navigation and Direction Finding.—H. Busignies & M. Dishal. (*Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, pp. 478–488.) The total bandwidth required for navigation and d.f. systems is quite small ($\leqslant 100$ c/s or so), because rates of change of observed phenomena are small and required speeds of indication low. A small total bandwidth is possible even with a complex waveform, provided that a filter can be designed with a number of very narrow pass bands occurring at the steady-state Fourier components of the complex signal. Such a 'comb' filter is briefly discussed.

Systems for which the output signal/noise ratio is better than the input carrier/noise ratio have improvement thresholds, but many navigation systems can give satisfactory information at output signal/noise ratios below these thresholds. Single-sideband and double-sideband a.m. produce the most sensitive systems under such conditions.

The phenomenon of 'apparent demodulation' is discussed for systems having the postdetection bandwidth Δf_v narrower than the predetection bandwidth Δf_{if} and carrier/noise ratio appreciably less than unity at the input to the final detector. A relation between the available power, the output signal/noise ratio $(S/N)_v$ required for satisfactory indication, the percentage modulation m, Δf_{if} and Δf_v is obtained for a double-sideband a.m. system with a linear final detector; this relation depends markedly on whether the quantity $4(\Delta f_{if}/\Delta f_v)(N/S)_v^2 m^2$ is greater than or less than unity.

621.396.93 **2233**

Radio Direction-Finding by the Cyclical Differential Measurement of Phase.—C. W. Earp & R. M. Godfrey. (*Elect. Commun.*, March 1949, Vol. 26, No. 1, pp. 52–75.) Reprint, with minor additions, of 1059 of April.

621.396.93 **2234**

Rotating H-Adcock Direction Finder.—B. G. Pressey. (*Wireless Engr*, March 1949, Vol. 26, No. 306, pp. 85–92.) The instrument has a frequency range of 4–30 Mc/s; the aerial system is about 4 ft overall. Spheres are fixed to the ends of the aerials to increase their effective height and measures are taken to balance the system throughout the frequency range. By splaying the points of connection of the aerial coil to the horizontal feeders, the polarization error is appreciably reduced. The minimum usable field-strength varies between 8 and 2.5 μV/m. The instrumental error is not greater than ½° and the polarization error is of the same order as that of a U-type Adcock system.

621.396.932 **2235**

Marine Navigation Radar.—G. Kniazeff. (*Onde élect.*, May 1949, Vol. 29, No. 266, pp. 202–215.) Technical requirements are discussed and tests with prototype equipment leading to the design of the RNMII set are described. This set operates at any frequency between 9 000 and 9 550 Mc/s. Power output is 30 kW, pulse duration 0.3 μs and repetition frequency 1 000 per sec. The beam angle is 1.8° in the horizontal and 17° in the vertical direction; the aerial, of the cylindro-parabolic reflector type with horn feed, rotates at about 30 r.p.m. The receiver has a panoramic display on a 22.5-cm screen. Four range scales are provided, with maxima of 1, 3, 9 and 27 miles respectively, and five circles on the screen facilitate accurate ranging. On the liner *Jean Bart* the performance of the equipment has proved very satisfactory.

621.396.933 **2236**

System of Air Navigation and Traffic Control recommended by the Radio Technical Commission for Aeronautics.—P. C. Sandretto. (*Elect. Commun.*, March 1949, Vol. 26, No. 1, pp. 17–27.) An outline of a completely integrated system to be developed and brought into use in the U.S.A. over a period of 15 years. The system is designed to meet a number of predetermined operational requirements. The basic techniques required have been developed during the war, but the exact technical characteristics and design parameters of the apparatus required cannot yet be given.

621.396.933.2 **2237**

Radio Beacons of the Consol Type.—H. Portier. (*Onde élect.*, Feb. 1949, Vol. 29, No. 263, pp. 57–65.) The basic principles are outlined and the effects of aerial spacing, aerial current and phasing, and signal cycle are discussed and illustrated by data for the transmitter at Bush Mill, N. Ireland. Proposals for new stations in Europe and America are mentioned.

621.396.933.23 **2238**

Radio Aids for Approach and Landing. Control of Aerial Traffic.—A. Violet. (*Onde élect.*, March 1949, Vol. 29, No. 264, pp. 91–109.) Present facilities are briefly reviewed and the requirements which future systems should satisfy are discussed, with special reference to the recommendations of the American

Radio Technical Commission for Aeronautics. The principles and operation of the navar, navaglide and navascreen systems are also described.

621.396.9 **2239**

Radar Primer. [Book Review]—J. L. Hornung. McGraw-Hill, New York, 1948, 210 pp., $3.50. (*Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, p. 543.) A non-mathematical presentation of the fundamental principles upon which the operation of pulsed radar is based. Various practical applications are briefly discussed.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788 **2240**

Radiometer Vacuum Gauge of Compensation Type.—A. Rostagni & I. Filosofo. (*Nuovo Cim.*, 1st Feb. 1947, Vol. 4, Nos. 1/2, pp. 74–84. In Italian, with English summary.) An instrument using two narrow strips of Al foil, one fixed at both ends and carrying a heater current, the other suspended freely from one end a few millimetres away from the first. Deflection of the suspended foil is compensated by rotation of the containing tube about a horizontal axis; the angle of rotation α is approximately proportional to the gas pressure p up to 10^{-2} tor and independent of the nature of the gas (for H_2, He, Ne, Ar, air). Above 10^{-2} tor the (α,p) curves for the different gases diverge; all reach a maximum and then fall off slowly. The useful pressure range is 10^{-1}–10^{-6} tor. Sensitivity can be varied widely by adjusting the heater current.

533.5 : 621.385.832 **2241**

Modern Vacuum-Pump Design.—G. L. Mellen. (*Electronics*, May 1949, Vol. 22, No. 5, pp. 90–95.) Detailed description of a vapour-type pump for television c.r. tubes. Automatic controls are suggested for further improvement of c.r. tube production rates.

535.37 **2242**

Temperature Quenching of Photoluminescence of Sublimated KI-Tl Phosphors.—K. V. Shalimova. (*Zh. eksp. teor. Fiz.*, Nov. 1948, Vol. 18, No. 11, pp. 1045–1048. In Russian.) An experimental investigation of films prepared in air by a simultaneous condensation of KI and metallic Tl on a quartz plate. The quenching process conforms to Mott's theory. The energy of activation U depends on the wavelength of the exciting light and on the concentration of the activator; the higher the concentration the lower is the value of U. The coefficient indicating the degree of binding of the mixture with the crystalline lattice remains constant, for a given concentration of the activator, for all wavelengths of the excitation light, and decreases with increase in the concentration of the activator. See also 230 of 1939 (Mott).

538.213 : 538.221 **2243**

High-Frequency Permeability.—J. Smidt. (*Appl. sci. Res.*, 1948, Vol. B1, No. 2, pp. 127–134.) Experimental results for the permeability of iron at frequencies between 360 and 580 Mc/s are discussed.

538.569.3/.4].029.64 **2244**

High-Frequency Absorption Phenomena in Liquids and Solids.—W. Jackson & J. A. Saxton. (*Proc. Instn elect. Engrs*, Part III, March 1949, Vol. 96, No. 40, pp. 77–80.) The paper discusses briefly the work on liquid and solid dielectrics carried out in England during the war and immediate post-war periods. The work was concerned mainly with substances of technical importance such as polythene, water and ice; the results emphasize the limitations of existing theories of dipolar absorption. Summary noted in 366 of February.

620.179.14 **2245**

Magnetic and Inductive Non-Destructive Testing of Metals.—I. R. Robinson. (*Metal Treatm.*, Spring 1949, Vol. 16, No. 57, pp. 12–24. Bibliography, p. 24.) Two general methods of testing are discussed: (*a*) The field set up by eddy currents in a ferrous or non-ferrous sample is compared with that due to a standard of the same size and shape; apparatus for testing bar stock by this method is described. (*b*) The sample is sprayed with ferromagnetic powder whose distribution over the surface of the magnetized material indicates leakage fields and hence flaws. Bridges and c.r. tube techniques are considered.

621.3.015.5 : 546.217 **2246**

The Electrical Breakdown Strength of Air at Ultra-High Frequencies.—J. A. Pim. (*Proc. Instn. elect. Engrs*, Part III, March 1949, Vol. 96, No. 40, pp. 117–129.) The measurements were made in the frequency range 100–300 Mc/s using parallel-plate gaps up to 1 mm wide. The apparatus and method of measurement are described and a theoretical analysis of the results is given. See also 3141 of 1948.

621.315.221 **2247**

Continuous Lead-Extrusion Machine for Electric Cables.—(*Engineering, Lond.*, 8th April 1949, Vol. 167, No. 4341, pp. 319–321.) Illustrated description of a machine made by the Pirelli-General Cable Works to overcome the difficulties inherent in stroke-type presses operating intermittently.

621.315.61 : 621.317.37.029.64 **2248**

Measurements on Dielectric Materials in the Centimetre-Wave Region at High Temperatures.—F. Borgnis. (*Helv. phys. Acta*, 20th April 1949, Vol. 22, No. 2, pp. 149–154. In German.) A cavity resonator constructed of calit, with its inner surface silvered, was used to measure the dielectric constant and loss of rods of various glasses and ceramics at temperatures up to 400°C. The results are tabulated. The loss factor of the ceramics (ergan, calit, frequenta, tempa *S*, condensa *C* and *F*) and of quartz, uviol glass and supremax glass showed no variations greater than the possible errors of measurement. The loss factor for selected examples of the large number of glasses tested increased 2 to 3 times between room temperature and 350°C.

621.315.616 : 679.5 **2249**

Electrical Properties of Plastics.—A. J. Warner. (*Elect. Commun.*, March 1949, Vol. 26, No. 1, pp. 33–39. Discussion, p.39.) Reprint of 3443 of 1948.

621.316.86 **2250**

Study of Uranium-Oxide Thermistors.—J. Prigent. (*J. Phys. Radium*, Feb. 1949, Vol. 10, No. 2, pp. 58–64.) Methods of preparing UO_2 powder and beads are described and test results are given showing the effect of applied voltage and of temperature on the resistance of the beads. On account of its variability and high resistivity, the use of UO_2 is likely to be limited to bolometer detectors for infra-red radiation; for such a purpose it is necessary to use a very thin layer of the oxide.

666.3 : 621.315.612 **2251**

Ceramics and their Manufacture.—R. A. Ijdens. (*Philips tech. Rev.*, Jan. 1949, Vol. 10, No. 7, pp. 205–213.) A survey of the different ceramic materials manufactured at Eindhoven, the methods used in their preparation, and also their applications. The relation between the characteristics of a material and its composition is discussed, with particular reference to the ternary system $MgO\text{-}Al_2O_3\text{-}SiO_2$.

669.718 : 534.321.9.001.8 **2252**

Supersonic Tinning of Aluminium Wires.—(*Machinery, Lond.*, 28th April 1949, Vol. 74, No. 1905, pp. 546–547.) Discussion of apparatus for making soldered joints without using flux. A Ni striker is immersed beneath the surface of molten solder in an electrically-heated crucible. The striker is made to oscillate at about 18 kc/s. The wire to be tinned is held by hand near or touching the striker, and becomes tinned over the short length immersed in a few seconds. For full details see B.I.O.S. Report No. 1844 (2253 below).

621.791 **2253**

Some Aspects of German Soldering, Brazing and Welding Methods. [Book Notice]—B.I.O.S. Final Report No. 1844. H.M. Stationery Office, London, 66 pp., 7s. A collection of miscellaneous data on metal-joining processes, including the ultrasonic tinning of Al referred to in 2252 above.

MATHEMATICS

517.5 **2254**

Remarks on the Harmonic Analysis of Aleatory Functions.—A. Blanc-Lapierre. (*Rev. sci., Paris*, 1st/15th Nov. 1947, Vol. 85, Nos. 3284/3285, pp. 1027–1040.) Aleatory functions of the second kind are defined and the method of filters is applied to their analysis. See also 1666 of 1948 (Blanc-Lapierre & Fortet).

517.512.2 : 578.088.7 **2255**

Fourier Analysis in relation to the Electrocardiogram.—W. E. Benham. (*J. Brit. Instn Radio Engrs*, May 1949, Vol. 9, No. 5, pp. 170–183.)

517.93 : 53 **2256**

Non-Linear Vibrations.—M. L. Cartwright. (*Advanc. Sci.*, April 1949, Vol. 6, No. 21, pp. 64–69. Bibliography, pp. 69–74.) Discussion of (*a*) general methods of solving nonlinear differential equations, including methods involving differential analysers, (*b*) special types of second-order equation, (*c*) difficulties of formulating the equation for a physical problem, (*d*) standards of rigour, (*e*) subharmonics, (*f*) relaxation oscillations, (*g*) numerical and graphical solutions, (*h*) topological methods, and (*i*) miscellaneous recent work. The bibliography is arranged according to the above sections, which are mainly a commentary on it. See also 156 of 1948 (Minorsky).

518.5 **2257**

Electronic Digital Counters.—W. H. Bliss. (*Elect. Engng, N.Y.*, April 1949, Vol. 68, No. 4, pp. 309–314.) Discussion of a circuit consisting of a binary chain of four multivibrators, with modifications that convert it to a decade system. The associated switching circuit is also considered. Various applications are mentioned.

518.5 : 621.385.832 **2258**

A Storage System for use with Binary-Digital Computing Machines.—F. C. Williams & T. Kilburn. (*Proc. Instn elect. Engrs*, Part II, April 1949, Vol. 96, No. 50, pp. 183–200. Discussion, pp. 200–202. Also published *ibid.*, Part III, March 1949, Vol. 96, No. 40, pp. 81–98. Discussion, pp. 98–100.) Full paper; summary abstracted in 1110 of April.

MEASUREMENTS AND TEST GEAR

531.763 **2259**

An Electronic Stopclock.—K. J. Brimley. (*Electronic Engng*, May 1949, Vol. 21, No. 255, pp. 180–183.) Fundamentally the arrangement is a high-speed mechanical counter in which a Scophony torque motor Type BTM is used, together with two thyratron inverters. This combination counts the quarter-cycles of a standard oscillator within the interval defined by the operation of two trigger circuits. Full circuit details are included, and the principle of the motor drive is explained.

621.3.018.41(083.74) **2260**

Some Electromechanical Methods for Producing Low Frequencies from a Primary Frequency Standard.—D. W. R. McKinley. (*Canad. J. Res.*, Feb. 1949, Vol. 27, Sec. F, No. 2, pp. 49–54.) The primary-standard crystal frequency of 50 kc/s is divided by the conventional chain of multivibrators to 10 kc/s, 1 kc/s, 100 c/s and 10 c/s. At the 1-kc/s stage, power is supplied to a 1-kc/s phonic clock motor, one shaft of which rotates at 10 r.p.s. and carries sector disks or needle disks whose elements generate pulses in the winding of an electromagnet as they pass between its poles. These pulses are used as gate pulses to select pulses of higher timing precision at the desired repetition rate.

621.317.32 + 621.317.34] : 621.396.11 **2261**

A Simple Method of Measuring Electrical Earth-Constants.—E. W. B. Gill. (*Proc. Instn elect. Engrs*, Part III, March 1949, Vol. 96, No. 40, pp. 141–144.) An incoming ground-wave is received in succession on two short sloping aerials of equal length, one in the vertical plane α containing the transmitter and the other in a vertical plane at right angles to α. The eccentricity of the ground-wave ellipse, and hence the earth constants, are calculated from the aerial slopes when the slopes are adjusted for equal signal amplitudes. Some measurements for S. England are tabulated.

621.317.323(083.74) **2262**

A Primary High-Frequency Voltage Standard.—(*Tech. Bull. nat. Bur. Stand.*, April 1949, Vol. 33, No. 4, pp. 43–44.) A thermistor bridge, using very small thermistors of diameter only 0.015 in., has been developed for measurements from 20 mV to 1.5 V at all frequencies from a.f. to 800 Mc/s. Careful design of a special mount for a 2-thermistor arrangement eliminated the need for frequency corrections and reduced the time required to balance the bridge. Up to 200 Mc/s measurements by means of a c.r.o., thermoelement, or e.s. voltmeter agreed with the bridge measurements to within 1%. Above 200 Mc/s the accuracy of available data is limited by inadequate precision of the slotted transmission lines used for power measurement. Up to 50 Mc/s the voltage range was extended to 10 V by use of thermistor beads of considerably larger diameter.

621.317.336 : 621.314.2 **2263**

Measurement of Transformer Impedance using Low Current Bridge Techniques.—K. Goldsmith. (*Elect. Times*, 21st April 1949, Vol. 115, No. 2998, pp. 522–526.) Bridge methods have definite advantages, but if carried out at the usual frequency of 1 000 c/s the results obtained may differ so greatly from those which would be obtained at the 50-c/s operating frequency that they would give an entirely wrong idea of the transformer performance. Bridge measurements should therefore be carried out at the normal operating frequency, using a vibration galvanometer or other suitable detector.

621.317.34 **2264**

Transmission-Line Impedance Measurement.—R. J. Lees, C. H. Westcott & F. Kay. (*Wireless Engr*, March 1949, Vol. 26, No. 306, pp. 78–84.) Balance-to-unbalance devices are discussed briefly. Early impedance measurements, carried out by observation of the detuning and damping of LC circuits, had an upper frequency limit of about 200 Mc/s. Measurements at somewhat higher frequencies were made on balanced lines by a standing-wave method. The voltage distribution was measured by means of a thermocouple at the end of a $\lambda/4$ stub.

For the range 500–600 Mc/s, a special measuring section was designed, consisting of a length of line of similar dimensions to the feeder, but with a slot along which the measuring stub could slide. A capacitance was used instead of a shorting bar. Experimental results discussed include admittance measurements on various slots.

621.317.35 **2265**

The Optimum Performance of a Wave Analyser.—N. F. Barber. (*Electronic Engng*, May 1949, Vol. 21, No. 255, pp. 175–179.)

621.317.372 **2266**

Q Measurements — Two- and Four-Terminal Networks.—M. C. Pease. (*Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, pp. 573–577.) Formulae are derived for calculating the resonance frequency and Q values of simple shunt-resonant networks from measurements of voltage s.w.r. at three frequencies. If these frequencies are suitably chosen, the formulae are greatly simplified. They are general and exact within the range for which the equivalent circuits are valid, with due regard to loss. For two-terminal networks an ambiguity exists which can be resolved only with simple phase data, but in practice the correct solution is usually obvious.

621.317.372 **2267**

Q-Meter Controversy.—P.H.: H.G.M.S.: V. A. Sheridan. (*Wireless World*, June 1949, Vol. 55, No. 6, pp. 216–218.) Comments on 1121 of April (Spratt).

621.317.7 + 621.38 + 621.396.69 **2268**

Physical Society's Exhibition.—(*See* 2198.)

621.317.71 : 621.385 **2269**

Electrometer Tubes for the Measurement of Small Currents.—Victoreen. (*See* 2376.)

621.317.73 : 621.396.67 : 629.135 **2270**

Measurement of Aerial Impedances in Aircraft.—P. Durand. (*Onde élect.*, Feb. 1949, Vol. 29, No. 263, pp. 73–78.) A coaxial cable of characteristic impedance 55 Ω and length 25 m is coiled round a drum of circumference 1 m. The polythene insulation is pierced at intervals of 10 cm to admit the probe of a high-impedance valve voltmeter; this instrument has a recording milliammeter in its cathode circuit. The standing waves along the cable, terminated by the aerial impedance to be measured, are shown by the voltages obtained by insertion of the probe successively in each of the holes, to make contact with the central conductor. A 150-W generator covering the range 300 kc/s–30 Mc/s is used. The resistive and reactive components of the impedance are determined from the reflection coefficient by means of Smith circle diagrams. An example shows the results obtained on an 8-m aerial in a Junkers-52 aircraft.

621.317.733 **2271**

Pulse Excitation of Impedance Bridges.—J. G. Yates. (*Nature, Lond.*, 22nd Jan. 1949, Vol. 163, No. 4134, p. 132.) Measurements can be made in many practical cases with rectangular pulses of duration 1 to 10 μs and of suitable recurrence frequency; sinusoidal excitation would require frequencies as low as 150 c/s, under similar conditions, to make the quadrature component in the bridge output negligible. A number of bridges can be excited in sequence by pulses and their output applied to a common amplifier. Pulse excitation can be used for capacitance as well as resistance bridges.

621.317.761 **2272**

A Compact Direct-Reading Audio-Frequency Meter.—A.A.McK. (*Electronics*, April 1949, Vol. 22, No. 4, pp. 108–109.) A cascade amplifier is followed by a squaring amplifier, the output from which is differentiated; the resultant pips are used to trigger a blocking oscillator. The integrated space current in the final triode driven by the positive half of the oscillation is read by a microammeter and is proportional to the frequency. Maximum readings of the three scales are 1 000, 5 000 and 10 000 c/s.

621.317.761.029.56/.58 **2273**

The Additive Frequency Meter.—G. Grammer. (*QST*, May 1949, Vol. 33, No. 5, pp. 32–37.) A suitable harmonic of a 100-kc/s crystal oscillator is fed to a mixer, together with the output of a v.f.o. covering a 50-kc/s range. The sidebands so generated supply a series of signals that can be used like the signal from an ordinary heterodyne meter. Dial errors are only of the order of 50 c/s and are independent of the frequency being measured. Errors due to instability of the v.f.o. are also small. Measurements can be made in any part of the spectrum where 100-kc/s harmonics can be heard. A similar principle has been used at the National Bureau of Standards for u.h.f. measurements.

621.317.784.088 **2274**

Some Sources of Error in Microwave Milliwattmeters.—G. F. Gainsborough. (*Proc. Instn elect. Engrs*, Part III, March 1949, Vol. 96, No. 40, p. 130.) Discussion on 3466 of 1948.

621.317.79 : 621.396.615 : 621.396.619.11 **2275**

Low-Distortion A.M. Signal Generator.—E. S. Sampson. (*Electronics*, April 1949, Vol. 22, No. 4, pp. 118–120.) The outputs of an a.f. amplifier and a r.f. oscillator are combined in a modulator to produce a signal with 75% modulation. By adding an out-of-phase component of the carrier signal through a cancellation amplifier, a signal is obtained with an effective modulation of 100%. Negative feedback is used in both the a.f. amplifier and the modulator, and an exalted-carrier detector is used in an overall feedback circuit.

621.317.79 : 621.396.822 **2276**

Atmospheric Noise Measurement.—H. Reiche. (*Electronics*, April 1949, Vol. 22, No. 4, pp. 110–113.) A description of equipment for continuous measurement of noise levels down to 0.3 μV/m over the frequency range 75 kc/s to 30 Mc/s. Three remotely situated wide-band preamplifiers, each covering about 10 Mc/s of the frequency range, have aerials attached and feed six receivers through coaxial cables. Each receiver is sampled in turn and the noise is recorded. The design of the first stage of the preamplifiers to give a low noise figure is discussed.

621.317.79 : 621.396.9.089.6 **2277**

Radar Range Calibrator.—R. L. Rod. (*Electronics*, April 1949, Vol. 22, No. 4, pp. 114–117.) Design of an instrument for production calibration of the concentric rings used for estimating distance with a p.p.i. Range ring pulses generated in the radar are compared on a triggered c.r.o. with spaced pulses from a crystal-controlled calibrator.

621.396.645 **2278**

Stabilized Decade-Gain Isolation Amplifier.—Keithley. (*See* 2190.)

621.396.69.001.4 (083.75) **2279**

Climatic and Durability Tests for Radio Components.—(*Engineer, Lond.*, 8th April 1949, Vol. 187, No. 4863, p. 393.) Brief details of specification No. RIC/11, obtainable (price 1s.) from the Radio Industry Council, 59, Russell Square, London, W.C.1. It covers approximately the same ground as the Inter-Services Specification No. RC.S/11.

621.317.755 **2280**

Elektronenstrahloszillographen. (Electron-Beam Oscillographs.) [Book Review]—P. E. Klein. Weidmannsche Verlagsbuchhandlung, Frankfurt-am-Main, 210 pp., 19 DM. (*Wireless Engr*, March 1949, Vol. 26, No. 306, p. 107.) Describes the tube itself and the auxiliary devices necessary for the practical application of c.r.o. methods of measurement; the applications themselves will be discussed in a second volume to appear later. Recommended for anyone wishing to study German c.r.o. development.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

534.321.9.001.8 **2281**

New British Ultrasonic Generator.—(*Electronic Engng*, May 1949, Vol. 21, No. 255, pp. 154, 161.) Designed as a laboratory tool for research workers in industry. A r.f. output of 1 kW is generated directly by a silica triode. Interchangeable coil assemblies are provided for operation at frequencies around ¼, ½, 1 and 2 Mc/s. The quartz-crystal oscillator can safely be immersed in liquids at temperatures up to 150°C.

538.569.2.047 : 621.315.61.011.5 **2282**

Dielectric Properties of the Human Body in the Microwave Region of the Spectrum.—T. S. England & N. A. Sharples. (*Nature, Lond.*, 26th March 1949, Vol. 163, No. 4143, pp. 487–488.) Homogeneous specimens were inserted in a waveguide cell between a metal plunger and a plug of polystyrene. Measured values of the absorption coefficient and phase constant for various body substances are tabulated and discussed.

538.569.2.047 : 621.38.001.8 **2283**

Investigations on the Biological Effects of Microwaves in view of their Therapeutic Application.—L. de Séguin, G. Castelain & M. Pelletier. (*Rev. sci., Paris*, 1st April 1948, Vol. 86, No. 3294, pp. 335–344.) Experiments are described which show that microwaves can modify, and even stimulate, certain biological processes. They provide a convenient and precise means for the therapeutic application of heat.

538.569.2.047 : 621.38.001.8 **2284**

Exposure [of animals] **to Microwaves.**—W. W. Salisbury, J. W. Clark & H. M. Hines. (*Electronics*, May 1949, Vol. 22, No. 5, pp. 66–67.) Experiments to find the effect of high-intensity 12-cm radiation on rabbits are briefly described. An intensity greater than 3 W/cm² can cause damage to certain tissues, such as those of the eye, without accompanying pain. The most vulnerable parts of the body are those not abundantly supplied with blood.

539.16.08 **2285**

Laboratory Pulse Counter.—L. E. Greenlee. (*Radio News, Radio-Electronic Engng Supplement*, June 1948, Vol. 10, No. 6, pp. 6–8 . . 31.) Design and construction of an experimental radiation counter for rates up to 600 pulses/min.

620.179.16 **2286**

Location of Internal Defects by Supersonics.—J. W. Dice. (*Instruments*, Dec. 1946, Vol. 19, No. 12, pp. 718–722.) An account of the Sperry ultrasonic reflectoscope, which provides (*a*) square waves of frequency continuously variable from 5 kc/s to 130 kc/s, serving as a distance marker, and (*b*) 1 000-V pulses of recurrence frequency variable from 0.5 Mc/s to 12 Mc/s and of duration 1 μs or more, which are applied to the crystal search unit and thence to the test piece through a film of oil. Illustrations are given of the pulse echoes seen on the screen of the associated c.r.o. in the case of cracks or similar defects in the material under investigation.

621.365.5 : 621.396.611.3 **2287**

On Circuits with Electromagnetic Coupling and their Application in H.F. Induction-Heating Equipment.—Pietermaat. (*See* 2174.)

621.365.92.029.64 **2288**

Some Possibilities of Heating by Centimetric Power.—R. Keitley. (*J. Brit. Instn Radio Engrs*, March 1949, Vol. 9, No. 3, pp. 97–121.) Discussion of basic principles, range of applications, and methods suitable for frequencies above 500 Mc/s, for which the linear dimensions of the system and load are large compared with λ. Stationary-wave patterns in the load, methods of preventing consequent non-uniform heating, and methods of avoiding or automatically correcting mismatch due to reflected waves which reach the generator are considered in detail. Methods of localizing the dissipation of h.f. power are analysed; three basic systems—resonator, beam, and transmission-line—are distinguished. Typical arrangements for heating thin films, threads or strips, and bulky objects are shown.

621.38 **2289**

Electronic Apparatus.—Schaffernicht; Knoll; Schwartz; Rukop. (*See* 2368.)

621.38.001.8 **2290**

Electronic Classifying, Cataloging, and Counting Systems.—J. H. Parsons. (*Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, pp. 564–568.)

621.384.611.1† **2291**

The Betatron.—J. Dosse. (*Rev. sci., Paris*, 1st April 1948, Vol. 86, No. 3294, pp. 357–367. Bibliography, pp. 367–368.) Discussion of basic principles, orbital stability, electron injection and extraction, effects of eddy currents in the magnet material, and practical examples. Mathematical theory is given in five appendices.

621.385.833 **2292**

Distortion-Free Electrostatic Lenses.—T. Mulvey & L. Jacob. (*Nature, Lond.*, 2nd April 1949, Vol. 163, No. 4144, pp. 525–526.) Distortion in symmetrical e.s. lenses of the 3-aperture type is eliminated by a suitable choice of the thickness of the central electrode.

621.385.833 : 535.371.07 **2293**

A New Fluorescent Screen for the Electron Microscope.—K. B. Merling. (*Nature, Lond.*, 2nd April 1949, Vol. 163, No. 4144, pp. 541–542.) Discussion of a screen made of Ag-activated Zn/Cd sulphide, which is much brighter than the conventional willemite screen.

621.385.833 : 535.61-15 : 621.383 **2294**

Electron-Optics of the Image Converter.—W. Veith. (*Rev. sci., Paris*, 15th Jan. 1948, Vol. 86, No. 3289, pp. 67–76.) The question of e.s. focusing in the image converter is discussed, different practical methods of effecting it are compared and optimum conditions for plane focusing without distortion are stated. A description of a corrected e.s. lens is also given.

621.38.001.8 **2295**

Applied Electronics. [Book Review]—D. H. Thomas. Blackie & Son, London, 132 pp., 7s. 6d. (*Beama J.*, March 1949, Vol. 56, No. 141, p. 96.) Based on a course of lectures to students in the final year of the Higher National Certificate course.

621.38.001.8 **2296**

Elementary Industrial Electronics. [Book Review]—W. R. Wellman. Macmillan, London, 371 pp., 22s. (*Beama J.*, March 1949, Vol. 56, No. 141, pp. 96–97.) For the beginner rather than the advanced student or engineer. " . . . [the book] is admirably suited to those with an interest in electronics and its applications but who possess little mathematical and technical knowledge."

621.38.001.8 **2297**

Techniques in Experimental Electronics. [Book Review]—C. H. Bachman. J. Wiley & Sons, New York, 243 pp., $3.50. (*Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, p. 542.) Concentrates on the conduction of electricity in a moderately high vacuum. "... the inclusion of many simple but pertinent details is the very feature that should make this book most valuable."

PROPAGATION OF WAVES

538.566 **2298**

On an Important Formula in the Theory of the Propagation of Radio Waves.—M. I. Ponomarev. (*Bull. Acad. Sci. U.R.S.S. tech. Sci.*, Sept. 1947, No. 9, pp. 1191–1192. In Russian.) It is claimed that M. V. Shuleikin proposed in 1923 a formula for the current in a receiving aerial similar to that of van der Pol (1930 Abstracts, pp. 560–561 and 1931 Abstracts, p. 375).

621.396.11 **2299**

A New Solution to the Problem of Vertical Angle-of-Arrival of Radio Waves.—E. W. Hamlin, P. A. Seay & W. E. Gordon. (*J. appl. Phys.*, March 1949, Vol. 20, No. 3, pp. 248–251.) A practical mathematical solution of the case of a signal consisting of direct and reflected waves arriving from different directions. The measurement of the amplitude and relative phase of the field at three equally-spaced positions in a vertical line gives sufficient information to enable the angle of arrival and intensity of each wave to be calculated. The formulae are applied to 3-cm transmissions over a 27-mile desert path in Arizona.

621.396.11 : 551.510.52 **2300**

Radar Reflections in the Lower Atmosphere.—A. B. Crawford. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, pp. 404–405.) Simultaneous radar and visual observations suggest that 'angels' are due to echoes from flying insects and birds. For other views, see 2769 of 1947 (Friis), 722 of 1948 (Gould) and 1761 of June (Gordon).

621.396.11 : 551.510.535 **2301**

Ionospheric Absorption and the Calculation of Fields at a Distance.—A. Haubert. (*Onde élect.*, April & May 1949, Vol. 29, Nos. 265 & 266, pp. 152–159 & 216–226.) A review of the theories and experimental results of many authors, aiming at the presentation of the principal conclusions and results as a concise whole. Semi-empirical methods of calculating the minimum usable frequency for a given link and a given time of day, or, for a given frequency, the received field as a function of distance and time of day, will be considered in a subsequent paper.

621.396.11 : [621.317.32 + 621.317.34 **2302**

A Simple Method of Measuring Electrical Earth-Constants.—Gill. (*See* 2261.)

621.396.812 **2303**

Propagation of V.H.F. Electromagnetic Waves over the Sea.—G. de Burlet. (*HF, Brussels*, 1949, No. 2, pp. 53–60. In French.) The general conditions for the propagation of very short waves are reviewed and a formula is established for the decrease of field strength (E) with distance (d), taking account of refraction and of the plane of polarization. Curves are given showing the dependence of E on d for waves of frequency from 40 to 300 Mc/s, polarized vertically or horizontally and extending beyond the e.m. horizon. Charts are also given showing the values of E which can be expected over the North Sea at distances up to 150 km from a 1-kW transmitter at Ostende, operating on a frequency of either 43 Mc/s or 75 Mc/s. Practical suggestions are made regarding optimum frequency, choice of aerial and plane of polarization, and power requirements.

621.396.812 **2304**

Calculation of Ground-Wave Field Strength over a Composite Land and Sea Path.—H. L. Kirke. (*Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, pp. 489–496.) Three possible methods are discussed—those of P. P. Eckersley (1930 Abstracts, p. 621), Somerville, and Millington (1753 of June and 2307 below). The methods are applied to paths between Start Point (Devon) and two points in Norfolk, and to a path in Denmark. Theoretical results obtained are compared with observations on these paths. The Eckersley method agrees less well with observation than the other two. The Somerville method is the simplest and is probably adequate for rough calculations where the conductivity data are of doubtful accuracy. The Millington method has the best theoretical justification. The differences between the three methods are small at l.f. and when the effect of the land/sea discontinuity is not large, but no one empirical method can be regarded as established for all conditions.

621.396.812 : 551.510.535 **2305**

The Absorption of Short Radio Waves in the Ionosphere and the Electric Field Intensity at the Point of Reception.—A. N. Kazantsev. (*Bull. Acad. Sci. U.R.S.S. tech. Sci.*, Sept. 1947, No. 9, pp. 1107–1136. In Russian.) The structure of the ionosphere and the chief properties of its various layers are considered. The absorption of radio waves by these layers is discussed and curves showing their coefficients of absorption are given. Methods are indicated for calculating the received field intensity and for determining the maximum and minimum operating frequency. The discussion is illustrated by numerous experimental curves. The need for further investigations, especially in the polar regions, is emphasized.

621.396.812 : 621.396.97 : 551.524.3 **2306**

Temperature Variations of Ground-Wave Signal Intensity at Standard Broadcast Frequencies.—F. R. Gracely. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, pp. 360–363.) Measurements over six paths of lengths from 76 to 558 miles at frequencies from 640 to 1 170 kc/s show that variations of ground-wave signal intensity appear to be more closely related to changes in temperature than to changes in any other single commonly observed meteorological quantity. The main conclusions are that there is a marked decrease in the intensity at the higher temperatures and that this decrease is approximately proportional to the path length. See also 2308 below.

621.396.812.029.62 **2307**

Ground-Wave Propagation Across a Land/Sea Boundary.—G. Millington. (*Nature, Lond.*, 22nd Jan. 1949, Vol. 163, No. 4134, p. 128.) A 77.575-Mc/s 10-W transmitter-receiver was situated at sea level about 1.4 km south of the Blackwater, Essex. A similar transmitter-receiver was moved towards the shore, across the Blackwater (a 2.2-km sea path) and beyond the opposite shore. Field-strength readings taken at intervals confirm the marked rise of field strength expected theoretically under certain conditions at a land/sea boundary. See also 1758 of June and 2304 above.

621.396.812.3 **2308**

Tropospheric Propagation on Lower Radio Frequencies.—D. W. Heightman. (*Nature, Lond.*, 2nd April 1949, Vol. 163, No. 4144, pp. 527–528.) Tropospheric effects should not be ignored even at frequencies below 1 Mc/s. Signal-strength measurements at 59 Mc/s, 3.58 Mc/s, 877 kc/s, 668 kc/s and 804 kc/s are shown graphically and correlated with the greatest change in relative humidity per 50-mb step of the corresponding Larkhill balloon soundings and the height of this change. Comparable ionosphere-sounding records did not account for the variations noted.

RECEPTION

621.396.621 **2309**

Superregeneration — An Analysis of the Linear Mode.—H. A. Glucksman. (*Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, pp. 500–504.) The effect of a sinusoidally varying damping factor on the behaviour of a tuned circuit is considered. The amplitude and frequency of this variation are the fundamental parameters distinguishing the superregenerator from the ordinary resonant circuit. Sensitivity and selectivity are considered as functions of these parameters. Multiple resonance and other circuit properties are deduced from the solution of the differential equation. See also 3501 of 1948 (Macfarlane & Whitehead).

621.396.621 **2310**

G.E.C. Model BRT400.—(*Wireless World*, May 1949, Vol. 55, No. 5, pp. 171–174.) An 11-valve superheterodyne receiver with an integral a.c. supply unit which can operate from mains voltages between 95 and 130 V or 195 and 250 V at 40–80 c/s. Frequency coverage is 150–350 kc/s and 550 kc/s–33 Mc/s in six switched ranges. Six alternative bandwidths between 0.5 kc/s and 9 kc/s are provided.

621.396.621 : 621.396.619.13 **2311**

The Response of Frequency Discriminators to Pulses.—E. F. Grant. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, pp. 387–392.) The time response of a simple shunt resonant circuit is analysed, and the results are applied to the behaviour of the Round-Travis and Foster-Seeley frequency discriminators. The condition for the discriminator to have only one crossover frequency in the desired frequency band is derived.

621.396.621.53 + 621.396.645 **2312**

Increase of Sensitivity of Amplifier and Mixer Stages for Metre and Decimetre Waves.—M. J. O. Strutt. (*Bull. schweiz. elektrotech. Ver.*, 28th June 1947, Vol. 38, No. 13, pp. 363–371. In German, with French summary.) Formulae for the maximum power-amplification are derived for narrow and for wide frequency bands in the decimetre-wave range. Theory relative to interference factors is developed and three rules are given whose application enables such factors to be reduced considerably and in ideal cases even eliminated. Practical application of these rules to grounded-grid amplifier stages and to multigrid mixers results in a reduction of the noise factor of about 15 db.

621.396.622 + 621.314.6 **2313**

Rectification.—Möller; Seiler; Sachse. (*See* 2330.)

621.396.822 : 621.396.619.16 **2314**

Noise-Suppression Characteristics of Pulse-Time Modulation.—S. Moskowitz & D. D. Grieg. (*Elect. Commun.*, March 1949, Vol. 26, No. 1, pp. 46–51.) Reprint of 2607 of 1948.

621.396.822 : 621.396.621 **2315**

Noise Figures for Receiver Input Circuits.—P. G. Sulzer. (*Tele-Tech*, May 1949, Vol. 8, No. 5, pp. 40–42, 57.) The following six circuits are compared from the noise standpoint and suggestions for the proper application of each are made: (*a*) single-ended grounded-cathode amplifier, (*b*) push-pull grounded-cathode amplifier, (*c*) cathode-follower circuit, (*d*) grounded-grid amplifier, (*e*) cathode-coupled amplifier, (*f*) Wallman circuit. Circuits (*a*), (*b*), (*c*), (*d*) and (*f*) all have essentially the same noise figure with modern high-μ valves. The cathode-coupled amplifier is definitely inferior to the other circuits. The choice of the best circuit for a given application depends largely upon whether a pentode or a triode valve is to be used. The pentode type of circuit is satisfactory for l.f. narrow-band applications, but triode circuits are usually preferable for h.f. wide-band receivers.

621.396.828 **2316**

Suppression of Electrical Interference to High-Frequency Apparatus in Naval Vessels.—A. Hunter. (*Proc. Instn elect. Engrs*, Part III, March 1949, Vol. 96, No. 40, pp. 159–165.) Screening and bonding, and internal and external suppression are considered for the range 10 kc/s–150 Mc/s. Details and performance of π-type filter boxes with air or dust-core chokes rated up to 150 A at 220 V are given. V.h.f. ignition suppressors of the capacitor type and lead-through bushing capacitors are described. The use of π-networks in the internal brushgear leads of machines is advocated if shunt capacitance is inadequate.

621.396.621.004.67 **2317**

Most-Often-Needed 1949 Radio Diagrams and Servicing Information. [Book Review]—M. N. Beitman. Supreme Publications, Chicago, 1949, 160 pp., $2.50. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, p. 418.) Continuation of 256 of 1948. Diagrams and repair data for 1949 radio sets made by 39 different manufacturers are included.

STATIONS AND COMMUNICATION SYSTEMS

621.39 **2318**

Telegraphy Service during the 5th Olympic Winter Sports, St. Moritz, 30th January-8th February 1948.—H. Wyss. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Dec. 1948, Vol. 26, No. 6, pp. 255–258. In German.) A short account of the general arrangements and special services, including Telex teletype and picture transmission facilities. See also 3243 of 1948 (Wettstein).

621.39.001.11 **2319**

Theoretical Limitations on the Rate of Transmission of Information.—W. G. Tuller. (*Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, pp. 468–478.) A theory is developed which takes account of first-order noise effects. The transmission of a quantity of information H over a given circuit is governed by the relation

$$H \leqslant 2\,BT \log\,(1 + C/N)$$

where B is the transmission-link bandwidth, T the time of transmission, and C/N the carrier/noise ratio. For large signal/noise ratios S/N, this formula leads to $S/N \leqslant (C/N)^{B/f}$, f being the channel bandwidth. Code transmission is capable of realizing the fullest capabilities of the general system, but in uncoded transmission $S/N \leqslant (C/N) \times (B/f)$. The inefficiency of existing communication systems is discussed. The advantages to be gained by the removal of internal message correlations and by analysis of the information content of a message are mentioned. The theory is applied to radar relays, telemeters, voice communication systems, servomechanisms, computers, etc. See also 1057 of 1947 (Gabor) and 1649 of June (Shannon).

621.39.001.11 **2320**

Communication Theory.—T. Roddam. (*Wireless World*, May 1949, Vol. 55, No. 5, pp. 162–164.) An elementary discussion of the validity of the Hartley law and of absolute criteria of performance for the transmission of coded messages in noise.

621.39.001.11 **2321**

A Note on the Theory of Communication.—J. D. Weston. (*Phil. Mag.*, April 1949, Vol. 40, No. 303, pp. 449–453.) A basis for a general quantitative theory is suggested. A coded message is represented as a vector in a space of an infinite number of dimensions; the process of transmission over an ideal signalling system is equivalent to a projection of this vector on to a subspace. A message will be accurately transmitted if, and only if, it is coded so that its associated vector lies entirely in the sub-space characterizing the signalling system.

621.395.34 : 621.385.032.212 **2322**

Application of Gas-Filled Tubes for Storage and Sending.—F. H. Bray, D. S. Ridler & W. A. G. Walsh. (*Elect. Commun.*, March 1949, Vol. 26, No. 1, pp. 28–32.)

621.395.365.3 **2323**

Automatic Change-Over to an Emergency Apparatus in a Communication System.—G. Hepp. (*Philips tech. Rev.*, Oct. 1946, Vol. 8, No. 10, pp. 310–314.) Two methods for automatic change-over to an emergency oscillator when the output signal falls below a certain amplitude are discussed. Where l.f. amplifiers are involved, a constant auxiliary signal outside the band of the signal to be amplified is added; this auxiliary signal brings about the change-over to the emergency amplifier.

621.396.619.16 **2324**

Pulse Communication Systems.—S. Van Mierlo. (*HF, Brussels*, 1949, Nos. 1 & 2, pp. 16–25 & 45–51. In French.) The principal pulse-amplitude, pulse-position and pulse-code systems are reviewed and discussed with particular reference to bandwidth and signal/noise ratio. Different types of distributors, modulators and demodulators are mentioned; two pulse-position systems and two commercial equipments are also discussed.

621.396.619.16 **2325**

Signal-to-Noise-Ratio Improvement in a P.C.M. System.—A. G. Clavier, P. F. Panter & W. Dite. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, pp. 355–359.) The output signal/noise power ratio (expressed in decibels) is approximately twice the corresponding input ratio, and is independent of the number of code digits provided this is large enough. The distortion due to quantization varies greatly with the number of code digits. A relation is found showing the number of digits for which the output noise power is equal to the distortion power for a given input signal/noise ratio.

621.396.65 **2326**

Directional Transmission Investigations in the Alps.—W. Klein. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st April 1949, Vol. 27, No. 2, pp. 49–69. In German.) A detailed account of experiments carried out between Monte Generoso, at the southern end of Lake Lugano, and the Jungfraujoch, using wavelengths of 15 cm and 2 m, and with 90-cm equipment linking Chasseral, Jungfraujoch, Monte Generoso and Lugano Central. For many of the tests relay stations on the NE ridge of the Jungfrau, or on neighbouring peaks, were used to provide line-of-sight paths between stations. Power for the relay stations was supplied by means of rubber-insulated cables connected to a point on the nearest available a.c. network. The equipment used and its installation are described and the results of field-strength measurements for the various links are tabulated and discussed. Typical field-strength records are reproduced. The results show that a multichannel telephony system with stations on the Jungfraujoch and Monte Generoso is quite practicable. A possible system of line-of-sight links connecting all the north of Switzerland with the south via the Jungfraujoch is illustrated and discussed.

621.396.931 **2327**

Radio-Telephony at Whitemoor Marshalling Yard.—(*Engineer, Lond.*, 25th March 1949, Vol. 187, No. 4861, pp. 326–327; *Engineering, Lond.*, 1st April 1949, Vol. 167, No. 4340, p. 306.) A two-way 85.425-Mc/s system having a fixed 12-W transmitter-receiver station in the control tower and a remote control unit in the foreman's cabin, and mobile 12-W transmitter-receiver units in the engine cabs, where 12-V batteries are fitted.

621.396.97 **2328**

Broadcasting at the 5th Olympic Winter Sports, St. Moritz.—F. Dupuis. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Dec. 1948, Vol. 26, No. 6, pp. 258–263. In French.) Details of the arrangements for Switzerland and also of the international connections with many European countries and with the U.S.A. Altogether 359 transmissions were arranged, 116 in Switzerland and the remainder abroad, the total duration of the transmissions being 273 hours. See also 3243 of 1948 (Wettstein).

SUBSIDIARY APPARATUS

621-526 : 061.3 **2329**

I.E.E. Convention on Automatic Regulators and Servomechanisms.—(*J. Instn elect. Engrs*, Part IIA, 1947, Vol. 94, Nos. 1 & 2.) These two issues contain the full text of all the papers mentioned in 4039 of 1947 and 829 of 1948, together with the following papers:—A Method of Analysing the Behaviour of Linear Systems in terms of Time Series, by A. Tustin. The Effects of Backlash and of Speed-Dependent Friction on the Stability of Closed-Cycle Control Systems, by A. Tustin. A Method of Analysing the Effect of Certain Kinds of Non-Linearity in Closed-Cycle Control Systems, by A. Tustin. Hydraulic Remote Position-Controllers, by J. E. M. Coombes. Electrical Remote Position-Indicating Systems as applied to Aircraft, by R. J. Garvey. Method of Testing Small Servo Mechanisms and Data-Transmission Systems, by E. W. Marchant & A. C. Robb. Some Characteristics of a Human Operator, by J. A. V. Bates.

621.314.6 + 621.396.622 **2330**

Rectification.—H. G. Möller; K. Seiler; H. Sachse. (*FIAT Review of German Science 1939–1946. Electronics, incl. Fundamental Emission Phenomena*, Part 1, 1948, pp. 259–295. In German.)

Section 1, by Möller, discusses valve rectification and heterodyne reception, with particular reference to Döhler's method of rectification (see 4383 of 1939) and also rectification and reception by means of Barkhausen oscillations.

Section 2, by Seiler, on detectors, outlines the Schottky theory of blocking-layer and point rectifiers and describes the synthesis and properties of sensitive, low-resistance detector materials and also the construction of the Telefunken detector Type ED705.

Section 3, by Sachse, briefly reviews work on oxide rectifiers for h.f.

621.316.7 **2331**

Application of the Method of Logarithmic Frequency Characteristics to the Investigation of the Stability of

Monitoring and Regulating Systems and to the Estimation of their Efficiency.—V. V. Solodovnikov. (*Avtomatika i Telemekhanika*, March/April 1948, Vol. 9, No. 2, pp. 85–103. In Russian.)

621.316.72 **2332**

Carrier Communication Level Regulator.—W. S. Chaskin. (*Electronics*, April 1949, Vol. 22, No. 4, pp. 104–107.) For correcting twist and maintaining the signal level constant within 2 db for 3-channel carrier telegraphy or telephony on open-wire lines.

621.316.722 **2333**

An Analysis of the Stability of an Electronic-Ionic Voltage Regulator.—L S. Gol'dfarb. (*Avtomatika i Telemekhanika*, May/June 1948, Vol. 9, No. 3, pp. 245–250. In Russian.) The operation of the usual type of electronic-ionic voltage regulator (Fig. 1), consisting of an exciter with variable feedback coupling, a voltage generator and a measurement element, is discussed. Equations for various circuits are given and it is shown that while the use of variable feedback coupling ensures stability, it also increases the time constant of the exciter and reduces the speed of the regulation process. A discussion of the circuit equations shows that it is advantageous to use higher amplification in the feedback channel and lower amplification in the measuring element. Design formulae and curves for the feedback coupling circuit are given.

621.316.722 : 621.3.013.1 **2334**

Rectifier Voltage Control using Saturable-Core Reactors.—F. Butler. (*Wireless World*, June 1949, Vol. 55, No. 6, pp. 227–229.) The principle is outlined and different methods of winding the reactors are discussed. A circuit diagram and performance figures are given for a full-wave Hg-vapour rectifier with reactor control; the output voltage remains between 970 and 1 000 V for a current range of 0 to 400 mA, while the voltage change for a current range of 100 to 400 mA does not exceed 1.5%.

621.316.726 **2335**

An Electronic Frequency Regulator.—I. S. Bruk, S. S. Chugunov & N. V. Pautin. (*Avtomatika i Telemekhanika*, March/April 1948, Vol. 9, No. 2, pp. 144–151. In Russian.) A description of a regulator employed to control the frequency of a 400-c/s oscillator feeding a circuit analyser. The regulator uses a tuning fork as a frequency standard and its accuracy is within 0.1%. A circuit diagram is given, with values of the components, and the operation is discussed in detail. Experimental curves are also included.

621.316.726.078 : 621.397.6 **2336**

Automatic Frequency Phase Control of Television Sweep Circuits.—E. L. Clark. (*Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, pp. 497–500.) Circuit diagrams are given and discussed for three types of a.f.c. system, namely: (*a*) a sawtooth system in which the sawtooth is formed from the pulse present across the deflection yoke and the phase of this sawtooth is compared with that of the synchronizing pulse to produce a voltage to control the sweep circuit, (*b*) a sinusoidal system in which a stable oscillator is controlled in phase and frequency by the synchronizing pulse and in turn controls the sweep circuit, (*c*) a pulse-time system in which the area of the synchronizing pulse, which is changed by phase variations, is used to develop a control voltage.

621.319.3 **2337**

Powerful Electrostatic Machines.—N. J. Feleci. (*J. Phys. Radium*, April 1949, Vol. 10, No. 4, pp. 137–144.) Discussion of the energy loss in e.s. machines at the commutator and due to gas friction leads to the conclusion that for the production of low or medium power, e.s. machines are superior to e.m. generators. Although great progress has been made recently in the design of e.s. generators, they are not likely to supersede e.m. generators for very high power.

TELEVISION AND PHOTOTELEGRAPHY

621.397.2/.3 **2338**

Experimental Transmitting and Receiving Equipment for High-Speed Facsimile Transmission.—H. Rinia, D. Kleis & M. van Tol. (*Philips tech. Rev.*, Jan. 1949, Vol. 10, No. 7, pp. 189–195.) Drawings, printed matter etc., up to 22 cm wide and of any length are electrically 'stuck' on an endless belt and scanned by a rapidly rotating optical system. A document of quarto size can be transmitted in 8 seconds. The image signals may be sent over either cable or radio links. At the receiving end, positive or negative reproductions, of one-sixth the size of the original, are 'written' on film, which can be rapidly processed to provide enlarged prints. Resolving power is 5 lines per mm. Applications are suggested and comparative advantages of the system assessed.

621.397.24 **2339**

Television Distribution over Short Wire Lines.—P. Adorian. (*J. Brit. Instn Radio Engrs*, March 1949, Vol. 9, No. 3, pp. 89–94.) Reception in closely populated areas, and particularly in blocks of flats, could be improved by using a common aerial and a local wire distribution system. In the system described, the complete carrier and sidebands of the transmitted programmes are received, amplified, and distributed over concentric cables. The amplifier, of which a circuit diagram is included, has a uniform gain of 55 db for frequencies between 42 and 48 Mc/s. Input voltage to receivers is between 7.5 mV and 0.75 mV for not more than 30 receivers on each line at distances up to 480 m.

621.397.26 **2340**

Ultrafax.—D. S. Bond & V. J. Duke. (*J. Brit. Instn Radio Engrs*, April 1949, Vol. 9, No. 4, pp. 146–156.) Reprint of 2055 of July. See also 1203 of April.

621.397.331.2 **2341**

High-Speed Production of Metal Kinescopes.—H. P. Steier & R. D. Faulkner. (*Electronics*, May 1949, Vol. 22, No. 5, pp. 81–83.) New techniques used in the manufacture of the R.C.A. 16-inch metal-cone c.r. tube Type 16 AP4.

621.397.5 **2342**

Wideband Television Transmission Systems.—E. Labin. (*Electronics*, May 1949, Vol. 22, No. 5, pp. 86–89.) A survey of the difficulties of obtaining bandwidths in excess of 40 Mc/s in the various elements of a television service. Video amplifiers, i.f. amplifiers, discriminators, f.m. klystrons and microwave aerials having the required performance are discussed. The limiting factors are considered to be transmitter output-stage bandwidth, propagation irregularities and the cost of the domestic receiver.

621.397.5 **2343**

Televising the 1949 Oxford and Cambridge Boat Race.—T. C. Macnamara & P. A. T. Bevan. (*Electronic Engng*, May 1949, Vol. 21, No. 255, pp. 165–168.) A single camera and associated apparatus was mounted in a river launch following the race. A small portable 25-W transmitter at a frequency between 50 and 60 Mc/s was used to transmit the picture signals to a shore station from which they could be relayed to Alexandra Palace. Power was supplied by a special petrol-electric generator. Pictures from shore cameras were used while the launch was near bridges.

621.397.5 (083.74) **2344**

Contribution to the Discussion of Television [line] **Standards.**—R. Barthélemy. (*Onde élect.*, May 1949, Vol. 29, No. 266, pp. 181–184.) A review leading to the conclusion that the logical solution of the problem lies in the adoption of a standard of 945 lines, with a video-frequency bandwidth of 15 Mc/s.

621.397.5 (083.74) **2345**

Reasons for the Choice of the 819-Line [standard]. **Reply to some Criticisms.**—Y. L. Delbord. (*Onde élect.*, May 1949, Vol. 29, No. 266, pp. 185–192.)

621.397.5 (083.74) **2346**

Theoretical Basis of the Choice of Television [line] **Standards.**—J. L. Delvaux. (*Onde élect.*, May 1949, Vol. 29, No. 266, pp. 193–201.) Discussion of the various factors which led to the selection of the 819-line standard for France.

621.397.6 : 621.396.65 **2347**

New York to Schenectady Television Relay.—F. M. Deerhake. (*Elect. Engng, N.Y.*, May 1949, Vol. 68, No. 5, pp. 419–422.) For an earlier account see 1792 of 1948.

621.397.6-182.3 **2348**

The WOW-TV Television Field Car.—J. Herold. (*Communications*, April 1949, Vol. 29, No. 4, pp. 12–13.) A console dolly is included so that the whole equipment can be operated at a distance from the car, which has a hydraulic levelling unit.

621.397.6-182.3 **2349**

Mobile TV Studio for WDTV.—W. I. McCord. (*FM-TV*, March 1949, Vol. 9, No. 3, pp. 20–21.) An illustrated description.

621.397.645 **2350**

Television Front-End Design : Parts 1 & 2.—H. M. Watts. (*Electronics*, April & May 1949, Vol. 22, Nos. 4 & 5, pp. 92–97 & 106–110.) Design equations are derived and illustrated for several types of r.f. amplifier stage for television receivers, including a cathode-coupled amplifier, and for several types of mixer. Emphasis is placed on the problem of obtaining the optimum signal/noise ratio while satisfying gain, bandwidth, and adjacent-channel rejection requirements.

621.397.7 **2351**

Low-Cost TV Operation.—G. W. Ray. (*FM-TV*, March 1949, Vol. 9, No. 3, pp. 24–27.) The video signals of selected programmes from New York are relayed by a microwave link to New Haven, the relay station being located on Oxford Hill, 8 miles from the New Haven transmitter. Audio signals are transmitted by telephone line. Reception in the New Haven area is quite satisfactory. Equipment is described.

621.397.8 (494) **2352**

First Practical Tests of Television Reception in Switzerland.—J. Dufour. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Dec. 1948, Vol. 26, No. 6, pp. 241–249. In French, with German summary.) An account of trials carried out in and near Zürich during the 20th Swiss radio exhibition, 26th–31st Aug. 1948, when television demonstrations were given by Philips-Lampen AG., Eindhoven. Field-strength measurements and subjective estimations of picture quality were made at many points up to a maximum distance of 16 km from the 80-W transmitter, which was installed on the Zürichberg, about 110 m above the centre of the town. The results obtained are tabulated and discussed. For field strengths > 3 mV/m reception was generally good, but reception was not possible for fields < 0.7 mV/m. The most common interference was that from car ignition systems, but some industrial h.f. generators were troublesome; one in particular, operating on 60.5 Mc/s, rendered reception in its neighbourhood quite impossible, as the video frequency used was 61.6 Mc/s. Analysis of the results shows that a 2-kW transmitter on the Uetliberg should give good reception over the whole of Zürich.

621.397.8 (73) **2353**

A Field Survey of Television Channel 5 Propagation of New York Metropolitan Area.—T. T. Goldsmith, Jr, R. P. Wakeman & J. D. O'Neill. (*Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, pp. 556–563.)

621.397.82 **2354**

TVI Patterns.—G.G. (*QST*, May 1949, Vol. 33, No. 5, pp. 43–45.) Photographs are reproduced and discussed which show the interference to television caused by a 28-Mc/s amateur transmitter, and the improvement effected by various remedial measures.

621.397.823 **2355**

Ignition Interference.—M. V. Callendar. (*Wireless Engr*, March 1949, Vol. 26, No. 306, p. 106.) To reduce ignition interference with television sound, it is quite as important to reduce the number of pulses in the train as to reduce the field radiated. See also 3741 of 1946 (Eaglesfield) and 1779 of June (Pressey & Ashwell).

621.397.828 **2356**

Further Advances in T.V.I. Suppression.—L. Varney. (*R.S.G.B. Bull.* May 1949, Vol. 24, No. 11, pp. 268–273.) It was found possible to operate various commercial television receivers close to a 14-Mc/s transmitter when suitable harmonic-suppression devices were used in the transmitter. The initial tests and means of suppression are discussed in detail. A harmonic monitor is described.

621.397.5 **2357**

Television. [Book Review]—M. G. Scroggie. Blackie & Sons, Glasgow, 2nd edn, 77 pp., 6s. (*Wireless World*, June 1949, Vol. 55, No. 6, p. 233.) " . . . a very simple and lucid explanation of how television works. . . . an excellent introduction to television."

621.397.62 **2358**

Television Receiver Construction. [Book Review]—Iliffe & Sons, London, 1948, 47 pp., 2s. 6d. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, p. 417.) Reprint of ten articles in *Wireless World* noted in 1186 of 1948 and back references.

TRANSMISSION

621.396.61 **2359**

The Development of German Broadcasting Transmitter Equipment during the War.—E. Wolf. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Feb. & 1st April 1949, Vol. 27, Nos. 1 & 2, pp. 24–33 & 78–85. In German.) A review of developments in all kinds of high-power transmitting equipment, including (*a*) the transmitters, their h.f. and output stages, modulators and measurement and monitoring racks, (*b*) power supplies and auxiliary equipment, and (*c*) aerials. The provision of a network of unattended low-power common-wave transmitters is also considered.

621.396.61 **2360**

High Power U.H.F. Transmitter.—H. C. Lawrence. (*Radio News, Radio-Electronic Engng Supplement*, May 1948, Vol. 10, No. 5, pp. 3–5 . . 29.) Two similar pulsed transmitters using Type 4C33 triodes and coaxial-line tuning elements give peak outputs of 300 kW over frequency bands of 390–465 Mc/s and 510–720 Mc/s respectively. The pulse duration is 5 μs and repetition rate 200 per sec. Mechanical layout, circuit details and the mode of operation of the tuning system are described.

621.396.619 **2361**

Modulation and Keying.—L. Pungs & K. Lamberts. (*FIAT Review of German Science 1939–1946. Electronics, incl. Fundamental Phenomena*, Part 1, 1948, pp. 251–258. In German.) Review of work in Germany on a.m. and f.m.

621.396.619.13 : 621.396.615 **2362**

A Simple Method of Producing Wide-Band Frequency Modulation.—H. Rakshit & N. Sarkar. (*Nature, Lond.*, 9th April 1949, Vol. 163, No. 4145, pp. 572–573.) F.m. can be produced in an oscillator with three identical stages by shunting one of the valves by a triode, and applying the modulating a.f. voltage to the grid of this triode. Results obtained with 6SK7 valves, using a 6C5 valve as the modulator, are shown graphically and discussed. A linear variation of over 3 kc/s was obtained with an oscillator frequency of about 1 Mc/s. See also 2356 of 1947 (Rakshit & Bhattacharyya).

621.396.619.23 **2363**

The Serrasoid F.M. Modulator.—J. R. Day. (*Proc. Radio Cl. Amer.*, 1949, Vol. 26, No. 1, pp. 3–13.) For another account see 342 of February.

621.396.619.23 : 621.396.615.17 **2364**

A Modulator Producing Pulses of 10^{-7} Second Duration at a 1-Mc/s Recurrence Frequency.—Morgan. (*See* 2185.)

621.396.645 **2365**

A Coaxial 50-kW F.M. Broadcast Amplifier.—D. L. Balthis. (*Electronics*, May 1949, Vol. 22, No. 5, pp. 68–73.) Describes the design and construction of the Symmetron amplifier for the 88–108-Mc/s f.m. band. Eight triodes, Type 3X2500A3, are connected in parallel. The anode and cathode tuned circuits are formed by two coaxial-cylinder resonators, one outside the other, the common intermediate cylinder being connected to the grid. Input, 12.5 kW, is between the cathode and the earthed resonator shorting bars, and output is between anode and grid. See also 592 of 1948 (Norton, Ballou & Chamberlin), *FM-TV*, March 1949, Vol. 9, No. 3, pp. 16–17 and *Tele-Tech*, April 1949, Vol. 8, No. 4, pp. 42–43 . . 57.

621.397.828 **2366**

Further Advances in T.V.I. Suppression.—Varney. (*See* 2356.)

VALVES AND THERMIONICS

621.314.6 + 621.396.622 **2367**

Rectification.—Möller; Seiler; Sachse. (*See* 2330.)

621.38 **2368**

Electronic Apparatus.—W. Schaffernicht; M. Knoll; E. Schwartz; H. Rukop. (*FIAT Review of German Science 1939–1946. Electronics, incl. Fundamental Emission Phenomena*, Part 1, 1948, pp. 43–146. In German.)

Section 1, by Schaffernicht, deals with photocells, including discussion of electron multipliers and of the properties of different light-sensitive layers.

Section 2, by Knoll, in collaboration with M. Stark, describes electron-microscope developments.

Section 3, by Schaffernicht, gives a detailed account of various types of infra-red image converter.

Section 4, by Schwartz, reviews work on c.r. tubes.

Section 5, by Rukop, gives construction and functional details of a wide variety of transmitting and receiving valves, gas-filled valves and stabilizers, with a short review of recent technical developments in materials and methods of construction.

621.383.4 **2369**

Temperature Coefficient of Sensitivity of Lead Sulphide Photo-Conductive Cells at Room Temperature.—S. S. Carlisle & G. Alderton. (*Nature, Lond.*, 2nd April 1949, Vol. 163, No. 4144, pp. 529–530.)

621.383.4 **2370**

Lead Sulfide Photoconductive Cells.—S. Pakswer. (*Electronics*, May 1949, Vol. 22, No. 5, pp. 111–115.) Practical operating data, characteristics and applications.

621.383.5 **2371**

The Efficiency of the Selenium Barrier-Photocell when used as a Converter of Light into Electrical Energy.—E. Billig & K. W. Plessner. (*Phil. Mag.*, May 1949, Vol. 40, No. 304, pp. 568–572.) Discussion shows that an efficiency of the order of 1%–4% is to be expected for monochromatic light of frequency near that for peak sensitivity, slightly lower efficiency for white light and much lower for the light from an incandescent lamp, which includes a good deal of infra-red radiation to which the Se cell is not sensitive. Measurements confirmed these conclusions. Houstoun's very low results (900 of March) are criticized.

621.385 **2372**

New Series of Miniature Valves of the Société Française Radioélectrique.—(*Ann. Radioélect.*, April 1949, Vol. 4, No. 16, pp. 163–164.) The bulb diameter is 19 mm and connections are sealed through the glass base. The principal electrical characteristics are tabulated for HM04 heptode frequency changer for a.m. or f.m. receivers, PM05 low-capacitance h.f. pentode, BPM04 output beam-tetrode, TM12 u.h.f. triode (for use as grounded-grid amplifier up to 500 Mc/s), T2M05 u.h.f. double triode (for use as mixer or oscillator up to 600 Mc/s), and D2M9 u.h.f. double diode. Equivalent American valves are respectively 6BE6, 6AK5, 6AQ5, 6JA, 6J6 and 6AL5.

621.385 **2373**

Planar Electrode Valves for V.H.F.—(*Wireless World*, May 1949, Vol. 55, No. 5, pp. 165–167.) Discussion of various valves with low interelectrode capacitance and transit time, with particular reference to disk-seal valves and an experimental triode, Type E1714.

621.385 : 519.283 **2374**

Quality Control in Radio-Tube Manufacture.—J. A. Davies. (*Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, pp. 548–556.) A general survey of methods used. Typical mount-inspection service, the use of statistical control charts, and sampling procedures are discussed.

621.385 : 538.122 **2375**

An Electron Tube for Viewing Magnetic Fields.—S. G. Lutz & S. J. Tetenbaum. (*Elect. Engng, N.Y.*, Dec. 1948, Vol. 67, No. 12, pp. 1143–1146.) The development of the special tubes is discussed, tubes with 5 cathodes and 8 anodes respectively are described, with illustrations, and design improvements are suggested. See alse 1919 of July.

621.385 : 621.317.71 **2376**

Electrometer Tubes for the Measurement of Small Currents.—J. A. Victoreen. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, pp. 432–441.) An account of the American VX series of valves, used to measure currents of order 10^{-12} A. Special problems discussed include the low anode voltage required to keep grid current very small, and the high-stability requirements for cathode emission. Curves show emission and anode and control-grid current characteristics. Typical circuits are given.

21.385.712 **2377**

Study and Realization of a New System of Forced-Air Cooling for Transmitting Valves.—J. Prévost, J. Boissière & A. Loukovski. (*Ann. Radioélect.*, April 1949, Vol. 4, No. 16, pp. 138–148.) Cooling by means of air currents is discussed theoretically. Various methods hitherto used and an improved method, developed by the Société indépendante de T.S.F. (S.I.F.) are considered. Special circular vanes of Cu, fitting round the cylindrical anode, have certain portions bent downwards to touch the vanes below so as to provide channels for the flow of air from two diametrically opposed sources. Alternate vanes are rotated through 180°. All are slightly conical, so that temperature differences between centre and edge only vary the angle of the cone. The cooling with this system is particularly efficient and allows continuous operation of valves at maximum dissipation for long periods.

621.385.01 **2378**

On the Co-Ordination of Circuit Requirements, Valve Characteristics and Electrode Design.—I. A. Harris. (*J. Brit. Instn Radio Engrs*, April 1949, Vol. 9, No. 4, pp. 125–143.) "A comprehensive theory is developed, combining the relevant parts of present-day circuit requirements with parts of the theories of electronic, mechanical and thermal limitations to valve electrode design, from which data on optimum design emerge. The scope includes amplifier valves with indirectly heated cathodes. Illustrations of theoretical design show general agreement with current practice and indicate directions in which improvement may be sought. Whilst not being a cut-and-dried formulation of valve design, its method may prove a powerful tool in facilitating further development." See also 2406 of 1946 (Liebmann) and 937 of 1947 (Ford).

621.385.029.63/.64 **2379**

Theory of the Travelling Wave Valve.—J. Laplume. (*Onde élect.*, Feb. 1949, Vol. 29, No. 263, pp. 66–72.) The method of Blanc-Lapierre, Lapostolle, Voge & Wallauschek (3421 of 1947 and back references) is extended to the more complex problem of the helix circuit, making use of results established by Roubine (3036 of 1947) for the case of no interaction between the electron beam and the helix. The pitch of the helix is assumed small enough for the field to be considered as symmetrical about the axis; the actual distribution of the helix current is replaced by a purely superficial helicoidal distribution on the surface of the generating cylinder, and resistance losses are neglected. The electron density and velocity are uniform over the beam cross-section and the velocity is everywhere parallel to the axis. Small-signal theory applies to the interaction between helix and beam.

The conditions prevailing (*a*) within the beam, (*b*) between the beam and helix, and (*c*) outside the helix are considered and formulae giving the field distribution are derived. Boundary conditions lead to six linear and homogeneous relations between six integration constants, and finally to an equation which defines implicitly the propagation constant and thus indicates the waves which can be propagated in the system. Particular cases are considered which result in considerable simplification of the wave equation and other formulae. The principal properties of the travelling-wave valve deduced from the wave equation are summarized and the effect of increased beam width is discussed quantitatively.

621.385.029.63/.64 **2380**

Travelling-Wave Valve.—V. M. Lopukhin. (*Uspekhi Fiz. Nauk*, Dec. 1948, Vol. 36, No. 4, pp. 456–477. In Russian.) The theory of the valve is discussed.

621.385.029.63/.64 **2381**

Effect of the Transverse Electric Vector in the Delay Line of the Travelling-Wave Valve: Part 2.—O. Doehler & W. Kleen. (*Ann. Radioélect.*, April 1949, Vol. 4, No. 16, pp. 117–130.) The form of the delay line affects the intensity of the radial field and hence, as explained in part 1 (2089 of July), the valve gain. A simplified form of the gain equations is given, taking account of the radial field, and the equations are developed for a helix system with a central conductor; such a system has an increased transverse field. Numerical results for this case are discussed. A qualitative explanation is given of the effects of space charge and of electron absorption by the line walls due to the existence of the h.f. electric vector. The effect of the displacement of the electrons in the radial electric field is negligible in comparison with other factors contributing to the gain. Oscillation of the electrons about their original trajectory in the absence of the h.f. field causes, in a longitudinal electric field, a displacement of the electrons, which varies with the radius. Electron bunching results and the wave propagation constant is altered, with a consequent increase of gain. In the case of a simple helix the gain increase is small, but in systems with intense radial fields the increase may be large and even predominant. The variation of the radius of the electron beam due to the radial h.f. field reduces the effect of the space charge on the gain. The resulting gain increase is considerable even for simple helix systems without a central conductor. Any diminution of gain due to electron absorption by the line walls is negligible.

621.385.029.63/.64 **2382**

Circuits for Travelling-Wave Tubes.—J. R. Pierce. (*Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, pp. 510–515.) Phase velocity v_ϕ, group velocity v_g and stored energy W per unit length are parameters which can be used for comparing different types of travelling-wave valves and associated circuits. Given W, lowering v_g relative to v_ϕ increases circuit impedance and gain, increases attenuation, and narrows the band. The effect of gap length in filter-type circuits consisting of pillbox resonators is discussed and the attenuation for such circuits is calculated. They are electrically much inferior to helix circuits.

621.385.029.64 **2383**

Beam-Deflection Mixer Tubes for U.H.F.—E. W. Herold & C. W. Mueller. (*Electronics*, May 1949, Vol. 22, No. 5, pp. 76–80.) These valves have an electron gun producing a thin rectangular beam, two pairs of deflector plates and an anode. An intercepting electrode is placed between deflector plates and anode so that voltages applied to the deflector plates cause variation in the current reaching the anode. One pair of deflectors receives the signal input, and the other pair receives the oscillator output. Advantages include a lower noise factor than that of a crystal mixer in the 1 000-Mc/s region, very small oscillator coupling and radiation, and high input impedance.

621.385.032.29 **2384**

The Virtual Cathode Problem for Cylindrical Electrodes.—A. van der Ziel. (*Appl. sci. Res.*, 1948, Vol. B1, No. 2, pp. 105–118.) The effect of space charge on the potential distribution between parallel electrodes is discussed. The current/voltage characteristics are then calculated for cylindrical electrodes; results are similar to those for plane electrodes. The theory may be useful for the development of cylindrical tetrodes and pentodes, especially transmitting valves.

621.385.032.29 **2385**

Resistive Films in Valves: Effect on Interelectrode Capacitance.—E. G. James & B. L. Humphreys. (*Wireless Engr*, March 1949, Vol. 26, No. 306, pp. 93–95.) The capacitance of such films varies as the square root of the frequency at h.f. and tends to a limit at l.f.

621.385.2 : 621.396.822 **2386**

Nonlinear Distortion and Noise in a Diode acted upon by U.H.F. Signals.—Yu. I. Kaznacheev. (*Bull. Acad. Sci. U.R.S.S. tech. Sci.*, Sept. 1947, No. 9, pp. 1173–1189. In Russian.) Equations are derived for the current in the circuit of a plane diode for the most general initial conditions, using a method similar to that proposed by Müller (1933 Abstracts, p. 433). In passing over from electron equations to current equations a different method from that proposed by Benham (148 of 1939) is used; a clearer physical interpretation of the theory is thus achieved. From the current equations general equations are derived determining the nonlinear distortion occurring in the amplification of u.h.f. signals, intermodulation of signals and noise, and the effect of the transit time of electrons on noise. The cases of weak and strong signals are treated separately. The results obtained can be applied to multi-electrode valves which can be regarded as consisting of a number of diodes.

621.385.2 : 621.396.822 **2387**

Measured Noise Characteristics at Long Transit Angles.—N. T. Lavoo. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, pp. 383–386.) Tests on diodes at 3 000 Mc/s indicate that the space-charge reduction of noise is of the order of 10:1 when the transit time exceeds 1 r.f. cycle. This applies to diodes having tungsten, thoriated-tungsten, or oxide emitters. The observed magnitude of the noise and its variation with transit time agree qualitatively with theory.

621.385.3 **2388**

Current Distribution in Triodes Neglecting Space Charge and Initial Velocities.—H. C. Hamaker. (*Appl. sci. Res.*, 1948, Vol. B1, No. 2, pp. 77–104.) A theory of current distribution, originally due to de Lussanet de la Sablonière (1933 Abstracts, p. 507), is clarified and developed for positive-grid triodes. A graphical method of checking the applicability of this theory to any set of observations is discussed; the different distribution functions which are involved in the equations can easily be determined from the graphs given. In some cases theory and experiment are in excellent agreement; discrepancies occurring in other cases are discussed. The basic assumptions underlying the theory are examined in the light of the experimental results.

621.385.3 : 621.396.619.13.029.64 **2389**

Certain Aspects of Triode Reactance-Tube Performance for Frequency Modulation at Ultra-High Frequencies.—C. L. Cuccia. (*RCA Rev.*, March 1949, Vol. 10, No. 1, pp. 74–98.) Investigation of the properties of reactance valves is extended to u.h.f., taking account of such factors as transit time and interelectrode capacitance. Formulae for the frequency deviation and Q of a transmission-line/reactance-valve system are derived. The grid swing limits the magnitude of the r.f. voltages in any such system. Mechanical detail, design and performance are discussed for a particular case in which a frequency deviation of 5 Mc/s was obtained.

621.385.3.029.64 **2390**

New Microwave Triode.—(*Electronics*, April 1949, Vol. 22, No. 4, pp. 171 . . 177.) Description of a close-spaced planar triode, Type BTL 1553, for operation at 4 000 Mc/s.

621.385.38 : 621.396.619.23 **2391**

Thyratrons in Radar Modulator Service.—H. H. Wittenberg. (*RCA Rev.*, March 1949, Vol. 10, No. 1, pp. 116–133.) The relations between performance and various characteristics and circuit parameters are shown.

621.385.38.032.213 **2392**

The Hot Cathode Hydrogen-Filled Thyratron.— H. de B. Knight & O. N. Hooker. (*Brit. Thomson Houston Activities*, March/April 1949, Vol. 20, No. 2, pp. 47–49.) The hydrogen filling permits operation as an electronic switch at frequencies much higher than those possible with Hg vapour, but a voltage drop of 50–70 V is required, instead of 10–15 V for Hg.

621.385.4/.5 **2393**

Increasing the Power Output of Vacuum Tubes.—B. M. Hadfield. (*Radio News, Radio-Electronic Engng Supplement*, May 1948, Vol. 10, No. 5, pp. 10–11.) The circuit of a pentode or tetrode, connected for use as a triode or diode, can be arranged so that a large part of the anode dissipation is transferred to an external resistance R without affecting the triode or diode characteristics. The conditions governing the maximum value of R and the reduction in anode dissipation obtainable are discussed. Application to voltage stabilizers of the cathode-follower type is considered.

621.385.5 **2394**

The Choice of Operating Conditions for Resistance-Capacitance-Coupled Pentodes.—F. Langford-Smith. (*Radiotronics*, July/Aug. 1948, No. 132, pp. 63–69.) Discussion of: (*a*) the optimum value of the anode load resistor for minimum distortion, (*b*) the optimum anode current for minimum distortion under given conditions, (*c*) the relative distortion characteristics of a pentode and a triode for given output voltage, (*d*) pentode operating conditions.

621.385.5 : 621.397.645 **2395**

Variation of the Input Impedance of Television-Amplifier Pentodes.—F. Juster. (*Télévis. franç.*, April 1949, No. 46, pp. 23–26, 36.) Discussion of the dependence of input-impedance variations on frequency and on valve characteristics. Results for specified valves are shown graphically. Methods of reducing such variations are indicated.

621.385.83 + 537.533 **2396**

Electron Emission and Electron Currents.—Mayer; Knoll. (*See* 2205.)

621.385.832 **2397**

Cathode-Ray Tubes with Post-Deflection Acceleration.—W. G. White. (*Electronic Engng*, March 1949, Vol. 21, No. 253, pp. 75–79.) The outstanding advantage of post-deflection acceleration (p.d.a.) is the increase in brightness obtainable for a given accelerating voltage. One form of p.d.a. electrode is a band of graphite on the inner circumference of the c.r. tube envelope near the fluorescent screen. Several such electrodes can be used. P.d.a. causes a slight reduction in sensitivity, and the electric fields near the p.d.a. electrode lose their radial symmetry. Various quantities are compared and tabulated for p.d.a. and ordinary tubes with e.s. or with e.m. deflection, but no general formula expressing the overall advantage of a p.d.a. tube can be deduced. The work of Pierce (1965 of 1941) is critically discussed.

621.385.832 : 533.5 **2398**

Modern Vacuum-Pump Design.—Mellen. (*See* 2241.)

621.385.832 : 621.397.6 **2399**

Development of a Large Metal Kinescope for Television.—H. P. Steier, J. Kelar, C. T. Lattimer & R. D. Faulkner.

(*RCA Rev.*, March 1949, Vol. 10, No. 1, pp. 43–58.) Discussion of a 16-in. c.r. tube Type 16AP4, and the associated design and construction problems.

621.396.615 **2400**
Generation of Oscillations.—Urtel; Gundlach; Frey; Schumann; Marx; Hettner. (*See* 2175.)

621.396.615.141.2 : 621.396.619.11 **2401**
A Spiral-Beam Method for the Amplitude Modulation of Magnetrons.—J. S. Donal & R. R. Bush. (*Proc. Inst. Radio Engrs, W. & E.*, April 1949, Vol. 37, No. 4, pp. 375–382.) A beam of electrons spiralling in a longitudinal magnetic field varies the conductance presented by a resonant cavity coupled to the magnetron, and so varies the power delivered to the load. The method has been applied to a 900-Mc/s c.w. magnetron, giving a peak power output of 500 W, with a modulating power of only about $\frac{1}{2}$ W. Satisfactorily linear voltage modulation is obtained up to a maximum depth of about 85%, while the frequency variation during the a.m. cycle is only ±15 kc/s. The system has been used to give a satisfactory reproduction of a television resolution pattern. Theory indicates that the method should be applicable at frequencies higher than 900 Mc/s.

621.396.615.142.2 **2402**
Klystrons.—H. Döring. (*Fernmeldetech. Z.*, April 1949, Vol. 2, No. 4, pp. 105–118.) Basic principles of operation are discussed and many types are described, with special reference to construction details and methods. The special features of all-metal reflex klystrons for wavelengths of about 3.2 cm and 6.5 mm respectively are described and clearly shown in section diagrams.

621.396.615.142.2 : 621.396.619.13 **2403**
Klystrons for F.M.—W. Henderson. (*FM-TV*, May 1949, Vol. 9, No. 5, pp. 17–19.) The special features of the Sperry SRL-17 reflex klystron are described, with a cut-away view showing the internal construction. The c.w. output is 3 W and the frequency range 920–990 Mc/s. For low-power local-oscillator service the beam voltage is +250 V, and the reflector voltage −150 V. F.m. of the output is simply obtained by applying the signal to the reflector.

621.396.645 : 537.311.33 : 621.315.59 **2404**
The Transistor — A New Semiconductor Amplifier.—J. A. Becker & J. N. Shive. (*Elect. Engng, N.Y.*, March 1949, Vol. 68, No. 3, pp. 215–221.) The construction of the Type-A transistor is described and the conventions regarding sign of current and voltages are given. Both large-signal and small-signal performance are discussed mathematically and the useful power obtainable, the internally generated noise, the useful frequency range and the effect of changes in ambient temperature are considered. For coaxial transistors, see 2406 below.

621.396.645 : 537.311.33 : 621.315.59 **2405**
The Type-A Transistor.—R. M. Ryder. (*Bell Lab. Rec.*, March 1949, Vol. 27, No. 3, pp. 89–93.) The type described is less than $\frac{1}{2}$in. long and under $\frac{1}{4}$in. in diameter. The static characteristics of the transfer properties between the contacts are shown graphically.

621.396.645 : 537.311.33 : 621.315.59 **2406**
The Coaxial Transistor.—W. E. Kock & R. L. Wallace, Jr. (*Elect. Engng, N.Y.*, March 1949, Vol. 68, No. 3, pp. 222–223.) The construction and characteristics of a transistor having point contacts placed on opposite sides of a thin Ge crystal plate are discussed. Advantages over the type-A transistor (2404 above) are briefly indicated.

621.396.645 : 537.311.33 : 621.315.59 **2407**
Coaxial Transistor.—(*Electronics*, March 1949, Vol. 22, No. 3, p. 128.) Satisfactory results are obtained when the two point contacts on a Ge disk are placed on opposite faces instead of the same face as in previous designs. The coaxially-mounted contacts rest in polished spherical depressions in the disk. Improved mechanical stability, complete e.s. screening between input and output and easier construction are claimed.

621.396.822 **2408**
Transit-Time Deterioration of Space-Charge Reduction of Shot Effect.—D. K. C. MacDonald. (*Phil. Mag.*, May 1949, Vol. 40, No. 304, pp. 561–568.) When space charge is present in a valve, the emission current from the cathode exhibits less fluctuation than in the absence of space charge. If this current drifts for some distance, as in a v.m. valve, it is to be expected that the fluctuation will increase until, after a sufficient time, the full shot noise is reached again. Analysis of this problem leads to a curve which shows the progressive increase of noise with drift time.

621.385 **2409**
Radio Valve Data. [Book Notice]—Iliffe & Sons, London, 80 pp., 3s. 6d. (*Wireless Engr*, March 1949, Vol. 26, No. 306, p. 84.) The characteristics of 1 600 British and American receiving valves are tabulated. The booklet is the post-war successor to the *Wireless World* Valve Data Supplements which used to appear annually.

MISCELLANEOUS

001.891 **2410**
The Radio Research Board.—(*Wireless Engr*, May 1949, Vol. 26, No. 308, pp. 145–146.) A historical review of its work (a minor part of which is the preparation of these abstracts) and of its relationship with the Department of Scientific and Industrial Research.

061.3 : 621.396 **2411**
International Radio Conferences.—R. L. Smith-Rose. (*Nature, Lond.*, 26th March 1949, Vol. 163, No. 4143, pp. 493–495.) A general survey of the main conclusions of various conferences held in the summer of 1948.

621.3.018.4 : 001.4 **2412**
Proposed Standard Frequency-Band Designations.—(*Proc. Inst. Radio Engrs, W. & E.*, May 1949, Vol. 37, No. 5, p. 467.) Discussion of a system in which 'Band n' includes all frequencies from 10^n c/s up to, but not including, 10^{n+1} c/s. Standard abbreviations for frequency and length units are also listed. For an alternative system see 2413 below.

621.3.018.4 : 001.4 **2413**
Nomenclature of Frequencies.—C. F. Booth. (*P.O. elect. Engrs' J.*, April 1949, Vol. 42, Part 1, pp. 47–49.) A new classification is proposed in which frequencies between 0.3×10^n c/s and 3×10^n c/s are defined to constitute 'Band n'. This is capable of unlimited extension. See also 2412 above.

5+6](43) **2414**
FIAT Review of German Science 1939-1946. Electronics, incl. Fundamental Emission Phenomena: Part 1. [Book Notice]—G. Goubau & J. Zenneck (Senior Authors). Office of Military Government for Germany, Field Information Agencies Technical, British, French, U.S., 1948, 295 pp.

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

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ACOUSTICS AND AUDIO FREQUENCIES

534.21 **2415**

On the Calculation of the Sound Field of Circular Membranes in a Rigid Wall.—H. Stenzel. (*Ann. Phys., Lpz.*, 1st March 1949, Vol. 4, No. 6, pp. 303–324.) Three developments in series are obtained, each with particular advantages for a certain portion of the field. A method is used involving characteristic functions which can be calculated by means of differential operators and which can be applied to radiation fields in general, including both acoustic and e.m. fields. Practical examples are given.

534.232 : 621.316.727 : 621.396.677 **2416**

Applications of Phase Devices.—Thiede. (*See* 2454.)

534.26 **2417**

The Diffraction of Two-Dimensional Sound Pulses incident on an Infinite Uniform Slit in a Perfectly Reflecting Screen.—E. N. Fox. (*Philos. Trans.*, 25th May 1949, Vol. 242, No. 839, pp. 1–32.)

534.61 **2418**

Application of Miniature-Circuit Techniques to the Sound Level Meter.—H. H. Scott, H. Chrystie & E. G. Dyett, Jr. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 33–45.) Engineering and production problems are considered for a meter small enough for a coat pocket, but meeting all American Standards Association requirements.

534.833 **2419**

Absorption by Sound-Absorbent Spheres.—R. K. Cook & P. Chrzanowski. (*Bur. Stand. J. Res.*, March 1949, Vol. 42, No. 3, pp. 219–223.) See 2123 of August.

534.862.4 : 621.383 **2420**

A New Reproducing Device for Scanning Optical Sound-Tracks.—J. Fassbender. (*Funk u. Ton*, May 1949, Vol. 3, No. 5, pp. 261–264.) Description of apparatus using a special photocell consisting of a single crystal of CdS, of dimensions about 10 × 1 × 0.1 mm. The conductivity spectrum of this cell extends from about 5 100 Å into the short-wave ultraviolet and its general properties make it particularly suitable for this application.

621.395.625.2 : 621.392.52 **2421**

Crossover Filter for Disc Recording Heads.—Roys. (*See* 2470.)

621.395.625.3 **2422**

Magnetic Recording Tapes.—M. Camras. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 503–506.) Magnetic properties, frequency response, signal/noise ratio, output level, sensitivity and ease of erasure are considered for various tapes. A new coated material, Type 140-A, developed by the Armour Research Foundation, is found specially suitable for high-quality recording.

621.395.625.3 : 621.395.813 **2423**

An Evaluation of the Application of New and Old Techniques to the Improvement of Magnetic Recording Systems.—L. C. Holmes. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, p. 46.) Summary only. Discussion of various factors contributing to high quality in such systems, and of data showing the performance characteristics obtainable under the most favourable operating conditions.

621.396.8 : 621.396.44 **2424**

Channels of Equal Acoustic Quality with Different Frequency-Response Characteristics and Different Bandwidths.—P. V. Anan'ev. (*Radiotekhnika, Moscow*, Jan./Feb. 1949, Vol. 4, No. 1, pp. 16–26. In Russian.) The necessary bandwidth and the permissible deviations in the frequency characteristic for a wire broadcasting system are discussed. Experimental curves and results are given.

AERIALS AND TRANSMISSION LINES

621.392.26† **2425**

Closed- and Open-Ridge Waveguide.—T. G. Mihran. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, pp. 640–644.) Expressions are derived for the voltage/current and voltage/power impedance, allowing for the discontinuity capacitance. Simplifying approximations and the conditions of their validity are discussed. A preliminary result can be obtained by using Cohn's curves (23 of 1948).

621.392.26† **2426**

Channel Section Waveguide Radiator.—A. L. Cullen. (*Phil. Mag.*, April 1949, Vol. 40, No. 303, pp. 417–428.) The transmission characteristics are studied theoretically and the phase constant and attenuation coefficient are calculated. Simple approximate formulae are deduced; the validity of these has been verified by experiment. The use of the device as a radiator is limited because the attenuation rate is too great for narrow beams to be obtainable, and the angle between the emergent beam and the normal to the array is rather large.

621.392.26† **2427**

A Set of Second-Order Differential Equations associated with Reflections in Rectangular Wave Guides — Application to Guide Connected to Horn.—S. O. Rice. (*Bell Syst. tech. J.*, Jan. 1949, Vol. 28, No. 1, pp. 136–156.) When a bent waveguide is conformally transformed into a straight guide filled with nonuniform medium, propagation may either be studied by an integral equation method (2428 below) or by a more general method based upon a certain set of ordinary differential equations. The latter method is here developed and applied to determine the reflection produced at the junction of a straight guide and a sectoral horn; this problem cannot be solved by the integral equation method. The *WKB* approximation, discussed for a single second-order differential equation by Schelkunoff (1570 of 1946), is extended to a set of equations and approximate expressions for the reflection coefficient are derived.

621.392.26†: 517.54 **2428**

Reflection from Corners in Rectangular Wave Guides — Conformal Transformation.—S. O. Rice. (*Bell Syst. tech. J.*, Jan. 1949, Vol. 28, No. 1, pp. 104–135.) Approximate expressions are obtained for the reflection coefficients for sharp corners by using a conformal transformation which replaces the bent guide by a straight guide filled with a nonuniform medium. The reflection coefficient for the transformed system can be expressed in terms of the solution of an integral equation, which may be solved approximately by successive substitutions. An explicit expression for the reflection coefficient can be obtained when the corner angle is small and the corner is not truncated. The method can be applied to other types of irregularities in rectangular waveguides. See also 2427 above.

621.392.26†: 621.3.09 **2429**

The Effect of Openings in the Walls of Metal Waveguides on the Wave Propagation.—G. Klages. (*Arch. elekt. Übertragung*, March 1949, Vol. 3, No. 3, pp. 85–92.) Theory of propagation in a lossless line in series with an attenuating line is applied to discussion of the effect of openings of various sizes. By analogy with the theory of reflection from optically-absorbing plates, the theory of an attenuating line is extended by the introduction of capacitance and inductance variations. Small openings in waveguide walls have no effect either on the propagation or on the attenuation, but with wide slits the wavelength inside the guide is increased and energy is radiated from the slits. The results of measurements with slits of different widths in different positions in both closed and open-ended rectangular waveguides are shown graphically and discussed. The effects of parasitic waves are also considered.

621.392.26†: 621.3.09 **2430**

Propagation of TE_{01} Waves in Curved Wave Guides.—W. J. Albersheim. (*Bell Syst. tech. J.*, Jan. 1949, Vol. 28, No. 1, pp. 1–32.) "TE_{01} waves transmitted through curved wave guides lose power by conversion to other modes, especially to TM_{11}.

"This power transfer to coupled modes is explained by the theory of coupled transmission lines. It is shown that the power interchange between coupled lines and their propagation constants can be derived from a single coupling discriminant.

"Earlier calculations of TE_{01} conversion loss in circular wave guide bends are confirmed and extended to S-shaped bends.

"Tolerance limits for random deflections from an average straight course are given."

621.392.26†: 621.3.09 **2431**

A Waveguide with Phase Velocity $v < c$ for the E_{10} Wave.—E. Kettel. (*Frequenz*, March 1949, Vol. 3, No. 3, pp. 73–75.) Propagation theory for a cylindrical waveguide with equally-spaced annular partitions. A formula for the phase velocity is derived.

621.392.26†: 621.396.67 **2432**

Open-Ended Waveguide Radiators.—R. E. Beam, M. M. Astrahan & H. F. Mathis. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 472–486.) Attempts were made to broaden the radiation pattern of open-ended $1 \times \frac{1}{2}$-in waveguide, operating at 9 375 Mc/s, by changing the shape of the opening. A 90° pointed end gave the widest pattern, but also gave a large amount of backward radiation. The effect of reflecting disks at various distances from the open end, and of polystyrene slugs and prisms within the end of the waveguide, was also investigated.

621.392.26†: 621.396.671 **2433**

Some Properties of Radiation from Rectangular Waveguides.—J. T. Bolljahn. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, pp. 617–621.) Exact relationships between the radiation pattern and impedance characteristics are developed for a waveguide with walls of infinitesimal thickness. The ratio of the radiation intensities in certain preferred directions to the power gain in those directions is simply related to the coefficient of reflection inside the waveguide.

621.392.3 **2434**

Directional Couplers.—W. W. Mumford. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, p. 625.) Correction to 2007 of 1947.

621.396.67 **2435**

A High-Gain Cloverleaf Antenna.—P. H. Smith. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 497–504.) Design is discussed. Laboratory tests on a $\frac{1}{10}$-scale model show that power gains of the order 10–12 can be obtained. The aerial is suitable for omnidirectional radiation of horizontally polarized waves, as required for f.m. broadcasting.

621.396.67 **2436**

Microwave Antennas and Dielectric Surfaces.—R. M. Redheffer. (*J. appl. Phys.*, April 1949, Vol. 20, No. 4, pp. 397–411.) Discussion of the effect of placing a dielectric sheet in front of an aerial for the following cases: (*a*) receiving aerial and plane sheet, (*b*) transmitting aerial and plane sheet, (*c*) transmitting aerial and cylindrical shell. In case (*a*), results are explained in terms of an equivalent aerial reflection; phase, arbitrary incidence and elliptical polarization are considered. In case (*b*) there is inverse-distance attenuation for a distant sheet; the effect of initial aerial mismatch is investigated. In case (*c*), reflection varies with angle according to the secondary power pattern. Formulae are given for the reflection from a circular cylinder, a narrow strip, a corrugated surface, or a series of strips, used with a paraboloid aerial. Applications to radomes and to the design of pressurizing seals are discussed. All results are verified experimentally.

621.396.67 **2437**

New Principle for Broad Band Antennas.—M. W. Scheldorf & J. F. Bridges. (*Tele-Tech*, June 1949, Vol. 8, No. 6, pp. 43–44.) Discussion of the characteristics of aerials consisting of several similar elements, which may be of different lengths, arranged in the form of a fan and fed from a common source. A bandwidth of over 10% was obtained with a symmetrical arrangement of 6 elements, the 3 pairs being of different lengths.

621.396.671 **2438**

Radiation Resistances of Loaded Antennas.—R. C. Raymond & W. Webb. (*J. appl. Phys.*, April 1949, Vol. 20, No. 4, pp. 328–330.) Short cylindrical aerials were loaded by cylindrical or conical dielectric sheaths or by metal end-disks so as to resonate at frequencies below the normal values. Measured resonance resistances are compared with values calculated by the Poynting vector method for assumed uniform or sinusoidal current distribution. For a given current distribution at resonance, the aerial radiation resistance depends only on the aerial length. Particular loading methods alter the current distribution. Those which give more nearly uniform current distributions yield higher radiation resistances. See also 2439 below.

621.396.671 **2439**

Current Distributions on some Simple Antennas.—W. Webb & R. C. Raymond. (*J. appl. Phys.*, April 1949, Vol. 20, No. 4, pp. 330–333.) A method of measurement is described and measured distributions are compared with some frequently assumed curves. Some distributions were integrated numerically to determine the driving-point impedances. Deviations from curves usually assumed are significant, but do not bring about large errors in the calculated impedances. See also 2438 above.

621.396.671 **2440**

Measured Impedance of Vertical Antennas over Finite Ground Planes.—A. S. Meier & W. P. Summers. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, pp. 609–616.) For a ground plane of dimensions small compared with λ the impedance is a damped oscillating function of λ and the ground-plane dimensions. Impedance variations of $\pm 5\%$ to $\pm 20\%$ were found with a circular ground plane ; the corresponding variations for a square ground plane were about half as great, except when the ground plane was small. Impedance is relatively independent of aerial thickness.

At microwave frequencies, measurements were made by a modified Chipman method (1618 of 1939) the merits of which are compared with those of the conventional slotted-line standing-wave method.

621.396.674 : 621.317.34 **2441**

Measurements on Frame Aerials.—E. Roeschen. (*Funk u. Ton*, May 1949, Vol. 3, No. 5, pp. 271–277.) The dependence of the effective height of a frame aerial on the number of turns of the winding and on the frequency is discussed. Measurements on tuned aerials, with and without screens, are tabulated. Screening increases the damping by about 15%.

621.396.677 **2442**

Directional Characteristics and Radiated Power of Directive Aerials.—(*Frequenz*, May 1949, Vol. 3, No. 5, pp. 152–153.) Long summary of paper abstracted in 1861 of 1948 (Saxton).

621.396.677 : 534.232 : 621.316.727 **2443**

Applications of Phase Devices.—Thiede. (*See* 2454.)

CIRCUITS AND CIRCUIT ELEMENTS

538.1 : 621.392.26† : 621.396.611.4 **2444**

Narrow Gaps in Microwave Problems.—W. R. Smythe. (*Rev. mod. Phys.*, July 1948, Vol. 20, No. 3, p. 472.) Correction to 2149 of August.

621.3(083.74) **2445**

Standardization in the Armed Forces.—L. J. Tatom & H. E. Bernstein. (*Tele-Tech*, June 1949, Vol. 8, No. 6, pp. 22–23 . . 57.) An account of the work of A.S.E.S.A. (Armed Services Electro Standards Agency), with examples of economies affected, such as the replacement of 350 different crystal holders by 3 standard types, the reduction of 10 000 different sizes and shapes of transformer cases to 22 standard types etc. In collaboration with the Radio Manufacturers Association, A.S.E.S.A. is responsible for the preparation of 'JAN' (Joint Army-Air-Navy) specifications for standard components.

621.314.25 **2446**

A Cross-Coupled Input and Phase Inverter Circuit.—J. N. Van Scoyoc. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, Nov. 1948, Vol. 11, No. 5, pp. 6–9.) The basic circuit is discussed. Advantages include low input capacitance, low sensitivity to hum and to anode supply voltage variations, and a large dynamic range of input signals. Application to a balanced amplifier for a c.r.o., a d.c. valve voltmeter, a.f. amplifiers and tone control are considered.

621.314.3† **2447**

An Analysis of Interlinked Electric and Magnetic Networks with Application to Magnetic Amplifiers.—D. W. ver Planck, M. Fishman & D. C. Beaumariage. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, p. 426.) Summary only. A general system of nonlinear equations is developed and applied to determine the steady-state behaviour of 6 types of magnetic amplifier without feedback. The relationship between current and time is determined for given applied voltages and circuit and core parameters. Results are confirmed experimentally. Amplifiers using two separate magnetic cores have important advantages over those using a single three-legged core. See also 2448 below.

621.314.3† **2448**

An Analysis of Magnetic Amplifiers with Feedback.—D. W. ver Planck, M. Fishman & D. C. Beaumariage. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, p. 436.) Summary only. Two methods of obtaining feedback are discussed, namely (*a*) external feedback, for which a bridge rectifier and separate coils for the feedback current are used, and (*b*) self feedback, for which two rectifier elements are arranged so that separate feedback windings are not required. The general system of equations discussed in 2447 above is applied; wave shapes and the magnitudes of the currents resulting from given applied voltages are obtained, and results are confirmed experimentally. The two methods of obtaining feedback have certain very similar characteristics.

621.314.3† **2449**

Effect of Core Materials on Magnetic Amplifier Design.—A. O. Black, Jr. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 427–435.)

621.314.3† **2450**

The Transductor.—H. B. Rex. (*Instruments*, Dec. 1947, Vol. 20, No. 12, pp. 1102–1109.) Discussion of (*a*) the transductor without self-excitation, (*b*) the self-excited transductor under various conditions of feedback, (*c*) the transductor with constrained magnetization. The article is based on papers by T. Buchhold in *Arch. Elektrotech.*, 1942–1944, noted in 3547 of 1942, 363 of 1943 and 55 of 1944. See also 2451 below.

621.314.3† : 016 **2451**

Bibliography on Transductors, Magnetic Amplifiers etc.—H. B. Rex. (*Instruments*, April 1948, Vol. 21, No. 4, pp. 332 . . 362.) A list of 213 references, with brief notes indicating the scope of many of the papers.

621.314.63 **2452**

A Practical Approach to Calculating Optimum Performance of Semiconductor Rectifiers.—E. D. Wilson. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 640–642. Discussion, p. 642.) By applying Kirchhoff's laws to a conventional 4-arm rectifier bridge, an expression is derived for efficiency in terms of the reverse (R), forward (F), and load (L) resistances. Maximum efficiency is obtained when $L^2 = R.F$; the forward and reverse losses are then equal. Efficiency/temperature curves are given for various current densities.

621.316.722.4 **2453**

Controlled Voltage Divider.—S. Freedman. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, Oct. 1948, Vol. 11, No. 4, pp. 7–9 . . 29.) The basic circuit is discussed for a device whose output depends only upon the ratio of two separate voltages applied to the input, and not on the actual values of these voltages. The principle is applied in an a.m./f.m. detector in which the undesired a.m. signal is eliminated during f.m. reception, and vice versa.

621.316.727 : 621.396.677 : 534.232 **2454**

Applications of Phase Devices.—H. Thiede. (*Funk u. Ton*, May 1949, Vol. 3, No. 5, pp. 249–255.) Arrangements are described for obtaining directional acoustic or radio beams from a number of radiators spaced uniformly in a straight line. The phases of the voltages applied to consecutive transmitters differ by an amount δ which determines the direction of the beam relative to the line of radiators. Circuits including n crossed-coil variometers, each connected to two of the $2n$ radiators, permit cyclical variation of the phase difference δ so that the beam can be swept through a prescribed angle without varying the position of the radiators. Typical directional characteristics obtained with 8 radiators in line are illustrated. Similar devices can be used for reception. See also 1873 and 2738 of 1948.

621.317.71 **2455**

An Automatic Current Integrator.—M. J. Poole. (*J. sci. Instrum.*, April 1949, Vol. 26, No. 4, pp. 113–114.) Circuit diagram and description of an instrument for measuring mean currents ranging from 2×10^{-9} A to 10^{-6} A. Arrangements are included to enable counting apparatus recording nuclear disintegrations to be switched on or off at exact charge intervals.

621.318.572 : 512.99 **2456**

The Synthesis of Two-Terminal Switching Circuits.—C. E. Shannon. (*Bell Syst. tech. J.*, Jan. 1949, Vol. 28, No. 1, pp. 59–98.) A general discussion of the design of a 2-terminal network with given operating characteristics. Boolean algebra is explained and used.

621.318.572 : 539.16.08 **2457**

An Improved Quench Circuit for Geiger Counters.—E. H. Cooke-Yarborough, C. D. Florida & C. N. Davey. (*J. sci. Instrum.*, April 1949, Vol. 26, No. 4, pp. 124–125.)

621.319 : 679.5 **2458**

The Electret.—F. Gutmann. (*Rev. mod. Phys.*, July 1948, Vol. 20, No. 3, pp. 457–470. Bibliography, pp. 471–472.) A comprehensive discussion of properties, methods of production and various theories.

621.385.832 : 535.767 **2459**

Cathode-Ray Presentation of Three-Dimensional Data.—O. H. Schmitt. (*J. appl. Phys.*, Sept. 1947, Vol. 18, No. 9, pp. 819–829.) I.R.E. 1947 Convention paper. By means of simple transformations easily performed electrically, isometric projections or true perspective views can be obtained. The observer's viewpoint can be changed at will by turning range, elevation and azimuth controls. A similar but more elaborate arrangement permits the presentation of separate pictures which are stereoscopically correct. See also 2984 of 1948 (Iams, Burtner & Chandler).

621.392 **2460**

Use of a Mechanical Harmonic Synthesizer in Electrical Network Analysis.—S. L. Brown & C. M. McKinney. (*J. appl. Phys.*, April 1949, Vol. 20, No. 4, pp. 316–318.)

621.392 **2461**

The Synthesis of Electric Networks According to Prescribed Transient Conditions.—M. Nadler. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, pp. 627–630.) A network function yielding a prescribed transient response may be determined by means of Laplace transforms. The procedure is based directly on the prescribed function of time, without consideration of amplitude or delay as a function of frequency. An example is given in which the Poisson-Stieltjes integral is used for the physical realization of a network function involving a transcendental term. The limitations of existing mathematical technique are briefly discussed.

621.392 **2462**

Synthesis of RC-Networks.—E. A. Guillemin. (*J. Math. Phys.*, April 1949, Vol. 28, No. 1, pp. 22–42.) The nature of the transfer characteristic of such networks is considered, and a method whereby any given transfer characteristic may be approached closely by means of a physically realizable passive RC network is discussed in detail. The synthesis procedure is illustrated by examples.

The physical realization of the required network is always possible in an unbalanced form suitable for operation between conventional valves. High-quality network performance does not necessarily require high-quality coils, provided that one can compensate for constant loss.

621.392 **2463**

Active Networks and the General Locus Criterion for Stability.—F. Strecker. (*Frequenz*, March 1949, Vol. 3, No. 3, pp. 78–84.)

621.392.4 **2464**

Graphical Method of Computation for Two-Terminal Networks with Nonlinear Resistances.—G. I. Nikonov. (*Avtomatika i Telemekhanika*, March/April 1949, Vol. 10, No. 2, pp. 149–156. In Russian.)

621.392.41 : 518.43 **2465**

Method of Integration by Successive Points (Step-by-Step Method) applied to Electrical Circuits.—G. Gillon. (*Rev. gén. Élect.*, May 1949, Vol. 58, No. 5, pp. 192–198.) A method allowing simple calculation of transients in circuits comprising resistance, inductance and capacitance. The approximation is good enough for plotting current and voltage curves and can be applied to circuits whose elements are variable or to complex circuits of the multiple-reactance type which lead to characteristic equations of high order.

621.392.43 **2466**

Broad-Band Dissipative Matching Structures for Microwaves.—H. J. Carlin. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, pp. 644–650.) Microwave network functions are studied by means of interpolation in the complex plane. A rational function can thus be found which approximates to a given network function over a specified bandwidth. A lumped-circuit approximation for a microwave structure can be deduced and used for the synthesis of matching networks. Where dissipative devices are involved, the poles of the rational approximating function may satisfy special conditions, in which case the ideal lumped matching network can be realized and transformed into a suitable microwave structure. Applications of this method and experimental results are given for the synthesis of a new type of broad-band coaxial 'chimney' attenuator.

621.392.5 **2467**

Foundations of the General Theory of the Linear Quadripole.—E. V. Zelyakh. (*Avtomatika i Telemekhanika,* March/April 1949, Vol. 10, No. 2, pp. 135–148. In Russian.)

621.392.52 : 537.228.1 **2468**

Crystal Filters using Ethylene Diamine Tartrate in place of Quartz.—E. S. Willis. (*Trans. Amer. Inst. elect. Engrs,* 1948, Vol. 67, Part 1, pp. 552–556.) Performance is comparable to that of quartz filters. See also 2215 of 1948, for which the above U.D.C. is preferable, and 2529 below.

621.392.52 : 621.392.26† **2469**

Analysis of a Wide-Band Waveguide Filter.—S. B. Cohn. (*Proc. Inst. Radio Engrs, W. & E.,* June 1949, Vol. 37, No. 6, pp. 651–656.) A rectangular waveguide structure consisting of a series of constrictions and cavities is shown to have the properties of a wide-band filter. The lower cut-off frequency of the lowest-frequency pass band is due to the cut-off property of the waveguide itself. The upper cut-off frequency of this band is due to the discontinuities. Exact equations for the image parameters are derived, assuming no dissipation in the filter sections; full allowance is made for the discontinuities and their interaction. Formulae are incidentally obtained for the equivalent circuits of cavities formed (*a*) by two changes in height, (*b*) by an increase in height followed by a short-circuiting wall, and for the hypothetical case of a cavity in which an increase in height is followed by an open-circuiting wall. The analysis for (*b*) can be used to obtain an improved solution for a ridged waveguide.

621.392.52 : 621.395.625.2 **2470**

Crossover Filter for Disc Recording Heads.—H. E. Roys. (*Audio Engng, N.Y.,* June 1949, Vol. 33, No. 6, pp. 18–21.) Description of a practical device designed to compensate for variations in cutter characteristics, both at the transition frequency and at the high-frequency end of the spectrum.

621.392.52 : 621.396.65 **2471**

Filters for a 150-kc/s Carrier System.—R. C. Taylor. (*Trans. Amer. Inst. elect. Engrs,* 1948, Vol. 67, Part 1, pp. 583–588.) Description of the filters used in the system discussed in 2637 below.

621.396.611.1 **2472**

Conditions for the Reproducibility of Properties and Parameters of Oscillatory Systems.—M. Päsler. (*Frequenz,* March 1949, Vol. 3, No. 3, pp. 76–78.)

621.396.611.1 : 621.317.6 : 621.396.645 **2473**

The Response of a Tuned Amplifier to a Signal Varying Linearly in Frequency.—W. H. Hamilton. (*Proc. nat. Electronics Conference, Chicago,* 1948, Vol. 4, pp. 377–396.) A mathematical analysis using the solution obtained from a differential analyser for the integral

$$U(2m,n) = \frac{2}{\pi} \int_0^n e^{2my} \cos y^2 dy$$

and a similar integral involving sin y^2. A response/time curve is obtained for various values of the parameter $\gamma = t \times$ bandwidth, t being the interval during which the frequency of the input signal is within the half-power bandwidth of the tuned circuit. A curve of signal/noise ratio as a function of γ is included. Results for a 456-kc/s amplifier are shown graphically. See also 670 of March (Barber & Ursell) and 671 of March (Hok).

621.396.611.21 **2474**

The Theory of a Self-Oscillator with a Quartz Crystal.—S. I. Evtyanov. (*Radiotekhnika, Moscow,* Jan./Feb. 1949, Vol. 4, No. 1, pp. 27–40. In Russian.) The quartz crystal is connected between the grid and filament. A vector method is used in the analysis. The condition for self-excitation is established and formulae are derived for determining the amplitude of steady-state oscillations and the frequency change corresponding to a change in the tuning of the anode circuit. The stability of steady-state operation is examined; when the tuning of the anode circuit is altered a hysteresis effect takes place in the oscillatory process.

621.396.611.3 : 621.396.619.13 **2475**

The Application of Coupled Systems with Distributed Constants to Frequency Modulation in the Ultra-High-Frequency Range.—V. A. Tolstikov. (*Radiotekhnika, Moscow,* March/April 1949, Vol. 4, No. 2, pp. 69–74. In Russian.) Modern f.m. methods for metre waves require manifold frequency multiplication even for sound broadcasting and it is doubtful whether these methods can be used at higher frequencies. Experiments were therefore conducted to show the effect of a secondary system with distributed constants on the frequency and amplitude of oscillations in a self-exciting system with distributed constants (Fig. 1). These experiments are discussed. It is possible in principle to obtain direct modulation of the carrier of sufficient depth without using frequency multiplication.

621.396.611.4 : 621.392.26† **2476**

Tunable Waveguide Cavity Resonator for Broadband Operation of Reflex Klystrons.—W. W. Harman. (*Proc. nat. Electronics Conference, Chicago,* 1948, Vol. 4, pp. 233–252.) A study of the design of broad-band resonators (2 : 1 tuning range) for use with reflex klystrons of the external-cavity type. Two groups are considered : (*a*) $\lambda/4$ or fundamental-mode resonators, whose h.f. limit is set by the physical size of the valve envelope, (*b*) $3\lambda/4$ resonators, which allow operation up to the electronic limit of the valve.

621.396.611.4.029.64/.65† **2477**

Modified Cavity Oscillator for the Generation of Microwaves.—G. G. Bruck. (*J. appl. Phys.,* Sept. 1947, Vol. 18, No. 9, pp. 843–844.) The cavity consists of two coaxial cylinders and two end-plates. The inner cylinder has *n* longitudinal slots. Electrons can be made to describe circular orbits between the cylinders by applying a positive potential to the inner one. No magnetic field is required. Because of progressive sorting, *n*-electron clouds are formed. The cathode and accelerating grid are both parallel to the cylinder axis. The voltage on the accelerating grid is so related to the potential difference between the cylinders that orbits are initially circular. Microwave power is extracted from the inner cavity. High output should be obtainable at frequencies above 30 kMc/s; this type of oscillator is thought capable of working at 100 kMc/s or higher.

621.396.615 **2478**

An Extremely Wide Range Electronically Deviable Oscillator.—M. E. Ames. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 397–405.) For another account see 2177 of August.

621.396.615 **2479**

Single-Sideband Generators.—E. L. Watkins. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, Dec. 1948, Vol. 11, No. 6, pp. 7–9..31.) A pair of balanced modulators in a phase-rotation system can be used to give single-sideband output.

621.396.615.029.64 **2480**

The Self-Excitation of a Triode Oscillator Loaded by a Line with Distributed Constants, at Microwave Frequencies.—V. A. Zore. (*Zh. tekh. Fiz.*, May 1949, Vol. 19, No. 5, pp. 570–577. In Russian.) The theory of Gvozdover & Zore (999 of April) is applied to the case of a triode oscillator loaded with a length of coaxial or 2-wire transmission line (Fig. 1). The operation of the oscillator is discussed and formulae (8) and (9) determining respectively the frequency and the condition of self-excitation are derived. The effect of the transit time of electrons on the condition for self-excitation is examined in detail and methods are indicated for determining the minimum wavelength that can be generated by the oscillator.

621.396.615.17 **2481**

An Improved Regenerative Frequency Standard Application.—F. E. Wyman. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 406–413.) This arrangement uses two tuned circuits in the mixer. It has a high division ratio (10 : 1), requires no voltage-regulated power supply and has satisfactory self-starting and locking qualities.

621.396.619 **2482**

Contribution to the General Theory of Modulation and Demodulation for Any Type of Characteristic.—O. Heymann. (*Arch. elekt. Übertragung*, March 1949, Vol. 3, No. 3, pp. 73–79.) The given characteristic is represented by a Fourier double integral; the valve output voltage can then be obtained directly as a Fourier series. The coefficients of this series are definite integrals whose integrands are given by the characteristic itself and two additional elementary functions. The form of the constant term of the series is particularly simple. This fact is very important in applications of the theory, since it enables the l.f. behaviour to be presented clearly and facilitates numerical evaluation. Two examples illustrate the usefulness of the general formulae.

621.396.621 **2483**

Wideband Frequency-Discriminator Design.—V. C. Rideout. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 414–424.) An analysis of the ordinary transformer-coupled frequency discriminator for the shunt-loaded case. For a slightly modified form of discriminator, the response can be calculated even for cases where the bandwidth is a large percentage of the centre frequency. The output voltage passes through zero at a frequency above the transformer mid-frequency; improvement in linearity can therefore be better effected by detuning than by overcoupling of the transformer.

621.396.645 **2484**

A Concise Theory of Aperiodic Amplifiers.—B. A. Khanov. (*Radiotekhnika, Moscow*, March/April 1949, Vol. 4, No. 2, pp. 57–68. In Russian.) In studying the operation of a l.f. amplification stage it is customary to consider three different equivalent circuits corresponding respectively to the lower, middle and upper frequencies of the bandwidth and to derive three separate equations for the frequency and phase characteristics of the stage. A single formula is here derived containing a minimum number of generalized parameters and describing in the simplest manner the characteristics of the main types of amplification circuits. The results obtained are tabulated.

621.396.645 **2485**

The Chain Amplifier.—H. Feigs. (*Funk u. Ton*, May 1949, Vol. 3, No. 5, pp. 291–301.) The principles and mode of operation of distributed-amplification circuits are considered. The grid/cathode capacitances of the amplifier valves on the one hand, and the anode/cathode capacitances on the other hand, form the cross capacitances of balanced transmission lines and are uniformly distributed along their length. The amplification and frequency characteristics of this type of amplifier are calculated from transmission-line theory; they are not subject to the limitations of the usual type of amplifier. A uniform frequency-response curve can be obtained from 0 to 200 Mc/s, using ordinary valves. The upper frequency limit is determined solely by the unavoidable grid loading of the valves. See also 3375 of 1948 (Ginzton et al.).

621.396.645 **2486**

A New Type of High-Frequency Amplifier.—J. R. Pierce & W. B. Hebenstreit. (*Bell Syst. tech. J.*, Jan. 1949, Vol. 28, No. 1, pp. 33–51.) Amplification is obtained by means of an electromechanical interaction within the electron flow, which consists of two streams with different average velocities. When the currents or charge densities of the two streams are sufficient, the streams interact to give an exponentially increasing wave. Conditions for and the gain of an increasing wave are determined for a particular geometry of flow.

Advantages include: (*a*) the electron flow need not pass close to complicated circuit elements, (*b*) for a sufficiently great length of electron flow, amplification can be obtained even though input and output circuits have very low impedance or poor coupling to the electron flow, (*c*) close synchronism between an electron velocity and a circuit-wave velocity is not essential. See also 2487 below.

621.396.645 **2487**

Experimental Observation of Amplification by Interaction between Two Electron Streams.—A. V. Hollenberg. (*Bell Syst. tech. J.*, Jan. 1949, Vol. 28, No. 1, pp. 52–58.) Discussion of the construction and performance of the amplifier used, which has identical input and output helices connected identically to a coaxial line several wavelengths long between the helices. Concentric tubular electron streams originate at the ring-shaped emitting surfaces of the two cathodes, pass through their respective control grids, and then through a common accelerating grid. An axial magnetic field of about 700 gauss is applied to maintain the definition of the streams. The gain produced depends on a difference in velocity between the two streams. The signal is impressed on the inner stream by the helix when its velocity is that at which travelling-wave amplifier interaction between the stream and helix occurs. The outer stream travels at a lower velocity. A gain of 33 db at a centre frequency of 255 Mc/s was observed, with bandwidth of 110 Mc/s between 3-db points. The gain at 240 Mc/s estimated from theory is 40 db. The theory of Pierce & Hebenstreit (2486 above) is thus qualitatively confirmed, though the actual conditions in the amplifier differ from the theoretical assumptions.

621.396.645 **2488**

Theory of the Superregenerative Amplifier.—L. Riebman. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, p. 608.) Corrections to 1627 of June.

621.396.645 **2489**

Transient Response of Cathode Followers in Video Circuits.—B. Y. Mills. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, pp. 631–633.) The effect of irregular radar or television video signals on cathode-follower circuits is analysed. The maximum signal amplitude which can be handled by a cathode follower may be reduced if it has a capacitive load. A general formula determining the reduction is given and its bearing on design procedure is discussed.

621.396.645 **2490**

New Developments in Preamplifiers.—C. J. LeBel. (*Audio Engng, N.Y.*, June 1949, Vol. 33, No. 6, pp. 9–12, 35.) A comprehensive discussion of the advantages of subminiature design techniques.

621.396.645 : 621.317.72 **2491**

D.C. Amplifier Stabilized for Zero and Gain.—Williams, Tarpley & Clark. (*See* 2563.)

621.396.645 : 621.385.029.63/.64 **2492**

A Note on Filter-Type Traveling-Wave Amplifiers.—Pierce & Wax. (*See* 2668.)

621.396.645 : 621.392.52 **2493**

Single-Circuit and Optimally Coupled Band Filters in Amplifiers.—A. Lennartz. (*Funk u. Ton*, May 1949, Vol. 3, No. 5, pp. 265–270.) Discussion shows that in general the symmetrical 2-stage band filter with optimum coupling is preferable, giving the greater amplification.

621.396.645 : 621.392.53 **2494**

Investigations on Path-Time Distortion in Carrier-Frequency Amplifiers.—G. Schaffstein. (*Frequenz*, May 1949, Vol. 3, No. 5, pp. 125–135.) Theoretical discussion and experimental results for directly transmitted signals show that the distortion can be largely reduced by the use of linear compensation networks with cross-connected members. Conditions for carrier transmission with a low degree of modulation resemble those for direct transmission, and similar compensation methods can be used. With a high degree of modulation, however, the resulting nonlinear distortion can only be eliminated by special methods. A circuit is described which, in spite of the relatively small bandwidth of the carrier-frequency amplifier, possesses a good frequency characteristic without path-time distortion, so that in pulse transmission a symmetrical output pulse can be obtained without appreciable broadening at the base.

621.396.645.37 **2495**

Single-Stage Feedback A.C. Amplifier.—W. Geyger. (*Funk u. Ton*, May 1949, Vol. 3, No. 5, pp. 278–285.) Discussion of the cathode-follower circuit with (*a*) current feedback, (*b*) voltage feedback, and (*c*) mixed current and voltage feedback, with formulae for the load current, output voltage and gain.

621.396.828 **2496**

Circuit Design for Reduction of Hum.—A. F. Dickerson. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, p. 425.) Summary only. The chief sources of hum are e.m. fields, electrical leakage, badly arranged input-circuit wiring, and cathode-heater leakage current. Hum in h.f. local oscillators is also discussed. Practical remedies are suggested, but no single device can eliminate all types of hum.

GENERAL PHYSICS

537.1 : 512.9 **2497**

Tensors and Electricity.—Bouthillon. (*See* 2541.)

537.52 : 538.569.029.5/.6 **2498**

Experimental Investigations on the High-Frequency Discharge.—M. Chenot. (*Ann. Phys., Paris*, May/June 1948, Vol. 3, pp. 277–373. Bibliography, pp. 373–375.) A comprehensive research. Evidence is given of the existence of wave-propagation phenomena in the motion of charged particles in discharge tubes; the propagation velocity is determined from measurements of the standing waves obtained with suitable excitation. A tentative theory of the observed effects is discussed.

Results are given for the voltage at which a discharge suddenly occurs in H_2, using frequencies from 1 Mc/s to 75 Mc/s and pressures from 10^{-4} mm to 1.5 mm Hg. The curves extend the results of other workers concerning the existence of abrupt variations of the sudden-discharge voltage. The dimensions and arrangement of the electrodes are of fundamental importance. Empirical relations are established between the various factors determining the amplitude of the abrupt voltage variation; a possible explanation of the effect is suggested. See also 1932 Abstracts, p. 217 (Gutton & Beauvais).

537.523.3 **2499**

Point-to-Plane Impulse Corona.—D. B. Moore & W. N. English. (*J. appl. Phys.*, April 1949, Vol. 20, No. 4, pp. 370–375.) Corona characteristics were investigated for both positive and negative square pulses of 1 μs or 2 μs duration, voltage up to 12 kV and repetition frequency 50–2 000 per sec. Typical photographs are included and results discussed. See also 2225 of 1948 (Loeb & English).

537.525 **2500**

Starting Potentials of Electrodeless Discharges.—E. W. B. Gill & A. von Engel. (*Proc. roy. Soc. A*, 11th May 1949, Vol. 197, No. 1048, pp. 107–124.) Discussion of measurements of the starting field at pressures between 0.2 mm and 350 mm Hg in H, N, Ne, D and He at wavelengths between 5 m and 2 km in vessels of different sizes and of different types of glass. The starting field rises slowly and continuously with λ until a kind of cut-off occurs, caused by the growing amplitude of electron oscillations and the corresponding rise of wall losses. In N, H, and D the sharp cut-off persists up to the highest pressure used. The cut-off extends over a considerable wavelength range in Ne at pressures above 0.2 mm Hg and in He above 0.5 mm Hg. Part 1, 1906 of 1948.

537.533.8 **2501**

Secondary Electron Emission.—H. Salow. (*Fernmeldetech. Z.*, June 1949, Vol. 2, No. 6, pp. 161–165.) Discussion of fundamental phenomena, dependence on the physical condition of metal surfaces, emission powers of compounds (including semiconductors, insulators and aggregated layers), and angular energy distribution, with a qualitative explanation of the experimental results.

538.541.029.64 **2502**

Effect of Surface Roughness on Eddy Current Losses at Microwave Frequencies.—S. P. Morgan, Jr. (*J. appl. Phys.*, April 1949, Vol. 20, No. 4, pp. 352–362.) The power dissipation in a metallic surface having regular parallel grooves whose dimensions are comparable to the eddy-current skin depth is investigated theoretically.

538.566.2 **2503**

Reflection and Transmission of Electromagnetic Waves by a Spherical Shell.—H. B. Keller & J. B. Keller. (*J. appl. Phys.*, April 1949, Vol. 20, No. 4, pp. 393–396.) Exact explicit expressions are obtained for the field of a radiating periodic point-dipole located in medium 1 at the centre of a spherical shell of medium 2, which is bounded by medium 3. The values of ϵ, μ, σ and the shell radii are arbitrary. The reflected and transmitted fields are examined for various special cases and results compared with those of other workers.

538.569.4 : 543/545 **2504**

Microwave Spectra and Chemical Analysis.—B. P. Dailey. (*Anal. Chem.*, May 1949, Vol. 21, No. 5, pp. 540–544.) The relevant principles of molecular dynamics are discussed. The relative merits of the microwave spectrometer, the mass spectrometer and infra-red instruments for chemical analysis are considered.

538.569.4.029.64 + 537.226.2] : 546.212 **2505**

Absorption of 12.5-mm Wave-Length Electromagnetic Radiation in Supercooled Water.—J. A. Saxton & J. A. Lane. (*Nature, Lond.*, 4th June 1949, Vol. 163, No. 4153, pp. 871–872.) Measurements have been made for layers of various thicknesses up to several millimetres; the lowest water temperature so far reached is -7°C. The water completely filled a cylindrical waveguide 24 mm in diameter over a portion of its length and the resulting attenuation was measured, using only the H_{11} wave. The waveguide was lined inside with glass and the probe covered with a glass sheath. The absorption-coefficient/temperature curve is shown. See also 1913 and 1914 of 1948 (Saxton).

548.0 : 537 : 539.16.08 **2506**

Crystal Counters: Part 1.—R. Hofstadter. (*Nucleonics*, April 1949, Vol. 4, No. 4, pp. 2–27. Bibliography, p. 27.) A comprehensive review. The theory of operation is outlined; important parameters are evaluated and the effect of impurities and faults in crystals is examined. Polarization effects, including those due to β-particles and penetrating radiation, are considered. Materials known to be capable of detecting single ionization events are AgCl, AgBr, C(diamond), ZnS, TlBr-TlI, CdS and solid and liquid Ar. Some relevant characteristics are given. No alkali halide has yet been successfully used as a counter.

Experimental techniques for the production of crystals and for their use as counters are described.

Advantages claimed for crystal counters are: (*a*) small size, (*b*) high stopping power, (*c*) low resolving time, (*d*) better conversion of ion pairs than in a gas. At present, difficulties are encountered due to crystal strains, polarization effects, variations in counting efficiency in different regions within the same crystal, annealing procedures and the requirements for operation at low temperatures. Part 2, 2507 below.

548.0 : 537 : 539.16.08 **2507**

Crystal Counters: Part 2.—R. Hofstadter. (*Nucleonics*, May 1949, Vol. 4, No. 5, pp. 29–43. Bibliography, p. 43.) Two fundamental quantities for crystal counters are (*a*) the electron mobility of the crystal, (*b*) the energy per ion pair. Experimental measurements of (*a*) can be compared with theory, but this is not yet possible for (*b*). Experimental results concerning polarization for various types of counter material are discussed. No general criterion can yet be formulated to distinguish materials which can be used as counters from those which cannot. Some crystals which appear to be single are actually mosaic; this, together with various properties briefly discussed, may explain the behaviour of particular crystals. The high stopping power of crystal counters leads to good linearity, especially for energetic particles. At present the bulky and complicated apparatus required for use with large silver or thallium halide crystals, which require low temperatures and annealing, is a serious disadvantage, but the discovery of a new room-temperature counting material would radically change the situation. For small detectors, little improvement upon diamond or CdS is to be expected. Part 1, 2506 above.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.53 : 621.396.9 **2508**

The Diffraction of Radio Waves from Meteor Trails and the Measurement of Meteor Velocities.—J. G. Davies & C. D. Ellyett. (*Phil. Mag.*, June 1949, Vol. 40, No. 305, pp. 614–626.) Automatic equipment, using pulse technique, is described for recording photographically the reflected amplitude of radio waves from meteor trails in time intervals of the order of milliseconds. Fluctuations in reflected amplitude like those associated with the diffraction of light at a straight edge are expected theoretically. Such fluctuations are associated with many meteor echoes, and the velocity of individual meteors can be deduced from the experimental results. Velocity measurements for meteors from known showers agree with earlier photographic and visual measurements. See also 3101 of 1948.

523.72 + 523.854] : 621.396.822 **2509**

Radio Astronomy.—C. R. Burrows. (*Sci. Mon., N.Y.*, May 1949, Vol. 68, No. 5, pp. 299–304.) Elementary discussion of: (*a*) the frequencies at which r.f. astronomical observations are possible, (*b*) the main differences in the requirements for radio telescopes and for communication receivers, (*c*) the variation of solar apparent temperature with frequency, (*d*) galactic radiation, and the location of its chief sources.

523.72 : 621.396.822 **2510**

Some Observations on Solar Noise.—Chief Engineer's Branch, General Post Office, Wellington. (*N.Z. J. Sci. Tech.*, Nov. 1947, Vol. 29, No. 3, Section B, pp. 140–141.) Discussion of observations made at Awarua during a period of high sunspot activity in February 1946, at frequencies between 6.7 and 25.6 Mc/s. Simultaneous d.f. observations prove conclusively the solar origin of the noise. Some of the noise surges lasted as long as one minute and reached high signal intensities.

523.72.029.63 : 523.746 : 621.396.822 **2511**

Relation between Decimetre-Wave Solar Radiations and Sunspots.—J. F. Denisse. (*C. R. Acad. Sci., Paris*, 16th May 1949, Vol. 228, No. 20, pp. 1571–1572.) The correlation coefficient between sunspots and the 10.7-cm solar radiations observed by Covington (2513 of 1948) shows a progressive increase according as comparison is made with (*a*) the relative sunspot number N, (*b*) the sum ΣA of the areas of the spots, (*c*) the daily index $\Sigma H_0\sqrt{A}$, where H_0 is the maximum magnetic field of a spot of area A. The correlation coefficients are respectively (*a*) 0.53, (*b*) 0.76, (*c*) 0.87.

523.75 **2512**

Solar Flares and their Terrestrial Effects.—M. A. Ellison. (*Nature, Lond.*, 14th May 1949, Vol. 163, No. 4150, pp. 749–753.) Substance of lecture to the Cavendish Laboratory Radio Section. Flares occur within a radius of 10^5 km of a visible sunspot, and most frequently between the leading and following elements of a bipolar group. The largest flares sometimes obscure the largest sunspots. An intense flare usually occurs as a brief flash of radiation followed by a slow decay. The development curve of such a flare is correlated with the corresponding observations of radio noise. Immediate effects, due mainly to ultraviolet radiations, include geomagnetic crochets, fading of s.w. signals, and anomalous changes in the phase of long waves due to changes in D-layer ionization. Delayed effects, due to particles, include geomagnetic storms and abnormal cosmic radiation. The theoretical work of Giovanelli (2230 of 1948 and 376 of February) and of Unsöld (2217 of August) is briefly mentioned.

551.510.5 : 621.396.9 **2513**
Radar as an Aid to the Study of the Atmosphere.—Jones. (*See* 2526.)

551.510.52 : 538.566 **2514**
On the Internal Reflection of Electromagnetic Waves in a Stratified Medium. Application to the Troposphere.—Eckart & Kahan. (*See* 2605.)

551.510.535 **2515**
The Reliability of Ionospheric Height Determinations.—L. A. Manning. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, pp. 599–603.) Continuation of 725 of 1948. Uncertainties in determinations of electron distribution based on virtual-height data are discussed. The effect of an assumed distribution between two layers upon the upper-layer form is investigated. A method is given for evaluating the maximum error in height determination.

551.510.535 **2516**
Critical-Frequency Difference Variations and the Poynting Vector in the Ionosphere.—J. C. W. Scott. (*Nature, Lond.*, 25th June 1949, Vol. 163, No. 4156, p. 993.) The variations in the f^x–f^o critical frequency difference noted in 717 of March can be explained in terms of a diurnal expansion and contraction of the F layer.

551.510.535 **2517**
Short-Period Variations in the Ionosphere.—G. H. Munro. (*Nature, Lond.*, 21st May 1949, Vol. 163, No. 4151, pp. 812–814.) Correlation of (h', f) records with the observations noted in 1664 of June establishes that the effects in question are due to local fluctuations in F-layer ionization, which show both a downward vertical and a horizontal progression. Results obtained on 22nd June 1948 are shown graphically and discussed.

551.510.535 **2518**
The Ionosphere over Mid-Germany in March 1949.—Dieminger. (*Fernmeldetech. Z.*, May 1949, Vol. 2, No. 5, p. 157.) Continuation of 1661 of June and 1934 of July. On various specified dates the limiting frequencies were from 10% to 35% below the normal value. See also 2519 below.

551.510.535 **2519**
The Ionosphere over Mid-Germany in April 1949.—Dieminger. (*Fernmeldetech. Z.*, June 1949, Vol. 2, No. 6, p. 172.) Continuation of 2518 above. In April the change from winter to summer ionosphere conditions was completed. Disturbances and abnormal values of critical frequency are noted.

551.510.535 : 621.396.11 **2520**
The Analysis of Ionospheric Reflections: Part 2.—de Voogt. (*See* 2606.)

551.594 : 523.78"1949.04.28" **2521**
Observations of the Atmospheric Electric Field during the [partial] **Solar Eclipse of 28th April 1949.**—J. Rouch. (*C. R. Acad. Sci., Paris*, 16th May 1949, Vol. 228, No. 20, pp. 1547–1549.) Field measurements in Monaco with a Wulf bifilar electrometer before, during and after the eclipse are plotted, together with results for the same period on the following day. Before the eclipse started the field strength was about normal for the season, with a value of 100–200 V/m. In the ¼ hour before the eclipse started, the field increased to 720 V/m. It remained high during the whole of the eclipse, with a peak reading >850 V/m; after the eclipse it oscillated around 550 V/m. On the following day there was a fairly regular increase from 200 V/m to 500 V/m. The mean value for the month of April is 300 V/m and no values as high as 600 V/m were reached. A marked increase of the electric field was also observed during the eclipse of 8th April 1921. The random variations of the field are, however, so frequent and sometimes so large that it is possible for the large field increases observed, both in 1949 and 1921, to be chance coincidences.

551.594.5 **2522**
Auroral Displays at Saskatoon.—W. Petrie, P. A. Forsyth & E. McConechy. (*Nature, Lond.*, 14th May 1949, Vol. 163, No. 4150, p. 774.) Brief description of intense displays observed during the nights of 24th/25th Jan. 1949 and 21st/22nd Feb. 1949. All auroral forms were present at some time during both displays. A large sunspot group passed the solar meridian on 22nd Jan. 1949 and was present, though reduced in size, on 21st Feb. 1949.

LOCATION AND AIDS TO NAVIGATION

534.88 : 623.96 **2523**
An Electroacoustical System.—E. A. Walker. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 35–40. Discussion, pp. 40–41.) The location of torpedoes lost in firing tests is discussed. An ultrasonic generator is fitted in the torpedo and the signal is detected by a portable hydrophone capable of giving the approximate bearing and depth of the source. The simple magnetostriction generator is driven by two 3Q5-GT valves, used as master oscillator and power amplifier, and produces a signal audible above background noise at 1 000 yd. Power is obtained from storage batteries.

621.396.9 **2524**
Radar.—E. G. Schneider. (*Bull. schweiz. elektrotech. Ver.*, 20th March–15th May 1948, Vol. 39, Nos. 6–10, pp. 192–196, 251–256, 290–291, 313–316 & 343–344.) Translation into German of an article noted in 3285 of 1946.

621.396.9 : 523.53 **2525**
The Diffraction of Radio Waves from Meteor Trails and the Measurement of Meteor Velocities.—Davies & Ellyett. (*See* 2508.)

621.396.9 : 551.510.5 **2526**
Radar as an Aid to the Study of the Atmosphere.—F. E. Jones. (*J. R. aero. Soc.*, May 1949, Vol. 53, No. 461, pp. 433–442. Discussion, pp. 442–448.) Radar is being used to investigate precipitation, to detect clouds dangerous to flying and to measure cloud height and wind velocity. Techniques are being developed for measuring pressure, temperature, humidity and atmospheric density in the upper air.

621.396.933(94) **2527**
Operational Trials of the Australian Distance-Measuring Equipment and Multiple-Track Radar Range.—J. G. Downes. (*Proc. Instn Radio Engrs, Aust.*, April 1948, Vol. 9, No. 4, pp. 10–21. Discussion, pp. 21–23.) The desirable features of short-range navigational aids for civil aircraft are discussed. The two equipments are briefly described. The D.M.E. is a beacon interrogator operating at 200 Mc/s and the presentation is on a

meter with scales of 0–12 and 0–120 miles. The M.T.R. is a hyperbolic navigation system using two synchronized pulse transmitters, operating on 212 Mc/s and a relatively short distance apart, so that the hyperbolic track system is nearly radial. The presentation consists of track numbers indicated on a meter.

The results of operational tests during regular flights between Melbourne and Sydney are fully described. Three ground stations were used, but the coverage was not complete over the 450-mile path.

MATERIALS AND SUBSIDIARY TECHNIQUES

531.788.7 **2528**

An Investigation on Hot-Wire Vacuum Gauges: Part 3.—H. von Ubisch. (*Ark. Mat. Astr. Fys.*, 21st Jan. 1949, Vol. 36, Part 1, Section A, No. 4, 14 pp. In English.) Part 1, 436 of 1948. Part 2, 731 of March.

537.228.1 **2529**

Design and Performance of Ethylene Diamine Tartrate Crystal Units.—J. P. Griffin & E. S. Pennell. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 557–560.) A general discussion, including comparison with corresponding quartz crystal units. See also 740 of 1948 (Mason) and 2468 above.

537.228.1 : 548.5 **2530**

Growing Crystals of Ethylene Diamine Tartrate.—A. C. Walker & G. T. Kohman. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 565–570. Discussion, p.570.) A general account of the apparatus used and of the process of growth.

537.312.62 **2531**

Properties of CbN at Radio Frequencies.—J. V. Lebacqz & D. H. Andrews. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 11–23.) When modulated r.f. signals are applied across a strip of CbN at its transition temperature, an a.f. voltage at the modulation frequency appears at the terminals. Experimental apparatus is described and results are discussed. A partial explanation based on the rapid change of resistance with current at certain temperatures is given. See also 3853 of 1947 (Andrews & Clark) and 3135 of 1948 (Lebacqz).

546.212-16 : 621.3.011.5.029.64 **2532**

The Dielectric Properties of Ice at 1.25 cm Wavelength.—J. Lamb & A. Turney. (*Proc. phys. Soc.*, 1st April 1949, Vol. 62, No. 352B, pp. 272–273.) The permittivity remains approximately constant at 3.18 between 0° C and − 200° C. The value of tan δ falls continuously with decreasing temperature. Any further dipole relaxation, apart from that giving a loss maximum at about 10^5 c/s, is unlikely. A large atomic polarization may account for the high value of the permittivity.

546.431.82 **2533**

Barium Titanates as Circuit Elements.—A. I. Dranetz, G. N. Howatt & J. W. Crownover. (*Tele-Tech*, April–June 1949, Vol. 8, Nos. 4–6, pp. 29–31 . . 55, 28–30 . . 57 & 36–39 . . 53.) Discussion of the dielectric and piezoelectric properties of $BaTiO_3$ ceramics, modern production methods, and applications.

546.431.82 **2534**

High Indices of Refraction of Barium Titanate and other Heteropolar Titanium Compounds.—J. H. van Santen & F. de Boer. (*Nature, Lond.*, 18th June 1949, Vol. 163, No. 4155, pp. 957–958.) A tentative explanation in terms of molecular structure and electronic polarization.

621.315.61 : 621.396.662.029.64 **2535**

Attenuator Materials, Attenuators and Terminations for Microwaves.—G. K. Teal, M. D. Rigterink & C. J. Frosch. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 419–428.) A similar but shorter paper was abstracted in 1691 of June.

621.315.612 **2536**

Ceramic Materials with a High Dielectric Constant.—E. J. W. Verwey & R. D. Bügel. (*Philips tech. Rev.*, Feb. 1949, Vol. 10, No. 8, pp. 231–238.) Theoretical reasons are given for the high value of the dielectric constant ϵ of TiO_2 (rutile). The effect of impurities in reducing the value of ϵ and varying its temperature coefficient is discussed. Admixture of MgO in suitable proportion gives a material for which ϵ is 12–18, temperature coefficient α is practically zero and tan δ is 10^{-4} at 1 000 c/s. For a mixture of 85% CeO_2 and 15% TiO_2, $\epsilon \approx 40$, α is roughly zero and tan $\delta \approx 8 \times 10^{-4}$ at 1 000 c/s. ZrO_2 can also be used to obtain a material with α about zero. As with other mixtures, the values of ϵ, α and tan δ depend on the proportion of ZrO_2.

621.315.612.011.5 **2537**

Development and Properties of some Ceramic Dielectrics.—G. R. Shelton, E. N. Bunting & A. S. Creamer. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 24–31.) The dielectric constant and its temperature coefficient and the reciprocal of the power factor are studied as functions of composition for various binary and ternary systems. Stability after storage for 6 months or more is also considered. See also 3551 of 1947 and 3441 of 1948.

621.318.322 : 621.385.612.1† **2538**

Soft Iron for the Electromagnet of a Cyclotron.—J. J. Went. (*Philips tech. Rev.*, Feb. 1949, Vol. 10, No. 8, pp. 246–254.) The iron for electromagnets should have high saturation flux density, relatively high remanence and low coercive force. The iron used for the 200-ton magnet of the Institute for Nuclear-Physical Research, Amsterdam, has a remanence 70% of the saturation value.

621.385.2.032.216 **2539**

Testing Cathode Materials in Factory Production.—Acker. (*See* 2674.)

621.385.2.032.216 **2540**

A Standard Diode for Electron-Tube Oxide-Coated Cathode-Core-Material Approval Tests.—McCormack. (*See* 2675.)

MATHEMATICS

512.9 : 537.1 **2541**

Tensors and Electricity.—L. Bouthillon. (*Bull. Soc. franç. Élect.*, May 1949, Vol. 9, No. 92, pp. 212–234.) A detailed tensor theory of electrostatics, magnetostatics and electromagnetism. Scalar and pseudoscalar quantities, polar and axial entities, the various products corresponding to the scalar and vector products of vector rotation, and the derivatives corresponding to the divergence, gradient, curl and Laplacian, can all be represented simply.

512.99 : 621.318.572 **2542**

The Synthesis of Two-Terminal Switching Circuits.—Shannon. (*See* 2456.)

517.727 : 518.12 : 621.392.52 **2543**

Numerical Computation of the Elliptic Function sn(mK/n), where m and n are Integers.—J. C. Stewart. (*Commun. Rev.*, March 1948, Vol. 1, No. 3, pp. 24–29.) K is the real quarter-period. The values of the function are required in the design of filters of the Tchebycheff type.

518.5 **2544**

Electro-Mechanical and Electronic Calculating Devices.—R. Davis-Berry. (*Trans. S. Afr. Inst. elect. Engrs*, March 1949, Vol. 40, Part 3, pp. 55–73. Discussion, pp. 73–75.) The fundamental circuits and general principles of operation of punched-card machines are fully discussed, with detailed diagrams. Simple electronic counters are briefly considered. The automatic sequence-controlled calculator (noted in 461, 468 and 787 of 1947) is described in detail. Limiting factors in the applications of such equipment to scientific and mathematical problems are examined.

518.5 **2545**

Design and Operation of the IBM Selective-Sequence Electronic Calculator.—R. R. Seeber, Jr. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, p. 288.) Summary only.

518.5 **2546**

A Large-Scale General-Purpose Electric Analog Computer.—E. L. Harder & G. D. McCann. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 664–673.) Description of the Westinghouse and California Institute of Technology computers, which only differ in minor matters. Accuracy is in general within 1–5% for the type of engineering problems to be solved.

518.5 **2547**

Analysis of Rototrol Voltage Regulators by Electrical Analogy.—J. T. Carleton. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 272–278.) Discussion of the principles of operation of the ANACOM, an analogue computer, made by the Westinghouse Electric Corporation.

518.5 : 512.37 **2548**

Root-Solver for Tenth-Degree Algebraic Equations.—J. F. Calvert, H. R. Johnston & G. H. Singer, Jr. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 254–271.) Theory and design of a proposed analogue computer are discussed. The coefficients in the equation may be complex.

MEASUREMENTS AND TEST GEAR

531.761 + 621.3.018.4(083.74) **2549**

The Atomic Clock.—H. Lyons. (*Instruments*, Feb. 1949, Vol. 22, No. 2, pp. 133–135, 174.) See 1983 of July.

621.3.011.4(083.74) **2550**

A Standard of Small Capacitance.—C. Snow. (*Bur. Stand. J. Res.*, March 1949, Vol. 42, No. 3, pp. 287–308.) A formula is derived for the capacitance of a parallel-plate capacitor with coplanar guard, the circular face of the electrode being at the bottom of a cylindrical hole in the guard. The analogous two-dimensional arrangement is also considered; an exact formula is obtained by conformal transformation and is used to determine the errors in certain general approximate formulae. With certain restrictions, easily fulfilled in practice, the resultant error is less than 0.05%.

621.3.018.41(083.74) **2551**

Absolute Accuracy. Primary Frequency Standard.—H. B. Meahl. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 446–450.) The sources of probable error in a primary frequency standard of the quartz-crystal-controlled oscillator type are analysed. Attempts to determine the long-term constancy of the rotation of the earth are discussed. Although quartz-crystal-controlled oscillators of special design have very good frequency stability and their frequencies can be compared with great precision, the absolute accuracy with which their frequencies are known is considered to be only within 1 part in 10^7.

621.3.018.41(083.74) **2552**

Microwave Frequency Measurements and Standards.—B. F. Husten & H. Lyons. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 321–328.) Full paper; long summary abstracted in 1712 of June.

621.317.3 : 621.385.38 **2553**

A Method for the Measurement of the Ionization and Deionization Times of Thyratron Tubes.—M. Birnbaum. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 209–214.) A circuit is described for generating rectangular pulses, with rise times less than 0.01 μs, for measurement of ionization times. For deionization-time measurement the thyratron is made to conduct and the anode voltage is then dropped below that of the cathode. At various intervals afterwards, anode voltage is suddenly reapplied: the maximum voltage which does not cause reignition is a measure of the degree of deionization. Results of measurements for various American thyratrons, including Types 2D21, 884 and 2050, are shown graphically. Circuit constants and methods of measurement are discussed for each case. Accuracy is estimated to be within 0.01 μs.

621.317.3.029.64 **2554**

Centimetre-Wave Measurement Technique.—H. H. Meinke. (*Arch. elekt. Übertragung*, Jan. & Feb. 1949, Vol. 3, Nos. 1 & 2, pp. 3–11 & 46–54.) Discussion of general principles, energy sources and detectors, resistance measurement, loss-free 4-poles and 6-poles, directional couplers, and power, frequency and phase measurement.

621.317.323(083.74) **2555**

A Primary High-Frequency Voltage Standard.—M. C. Selby. (*Instruments*, April 1949, Vol. 22, No. 4, pp. 318–319.) See also 2262 of August.

621.317.331 : 621.319.4.015.3 **2556**

A Method of Measurement of the Internal Series Resistance of a Capacitor under Surge Conditions.—B. S. Melton. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, pp. 690–693.) A ballistic method, using a vacuum thermocouple and a galvanometer.

621.317.335.3.029.64† : 621.315.611.011.5 **2557**

Microwave Dielectric Measurements.—T. W. Dakin & C. N. Works. (*J. appl. Phys.*, Sept. 1947, Vol. 18, No. 9, pp. 789–796.) The method of Roberts & von Hippel (178 of 1947) was used with 10-cm and 3-cm waves. A simplified procedure for calculating the dielectric properties from the measurements is given. Results are tabulated.

621.317.336 **2558**

The Measurement of Antenna Impedance using a Receiving Antenna.—D. G. Wilson & R. W. P. King. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, p. 496.) Summary only. Energy from a remote transmitter was received by an aerial located above a large conducting plane and terminated in a slotted coaxial cavity. The combined phase and damping functions for the two ends of the cavity were determined by the resonance-curve method. Since the phase and damping due to the lower end could be measured independently, the phase and damping due to the upper end could be found and used to calculate the aerial impedance. Curves of impedance as a function of length of aerial were obtained for several aerials. The impedance of a dipole, as determined in this way, was in reasonable agreement with the value measured when using the same apparatus as a transmitting system.

621.317.336 **2559**

Antenna Impedance Measurement by Reflection Method.—E. Istvánffy. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, pp. 604–608.) The dipole whose impedance is to be measured is mounted on a small wooden carriage which can be moved along a track in front of transmitting and receiving parabolic reflectors mounted side by side. The amplitude of the received signal depends on the power reflected by the dipole, and the target distance for maximum power depends on the phase of the dipole impedance. Results obtained for dipoles of various lengths and diameters of 0.14, 0.48, 3, 13.6 and 40 mm are discussed.

621.317.373.029.64 **2560**

A Method of Measuring Phase at Microwave Frequencies.—S. D. Robertson. (*Bell Syst. tech. J.*, Jan. 1949, Vol. 28, No. 1, pp. 99–103.) One part of the output of a signal generator is modulated by an a.f. signal in a balanced modulator. The resulting suppressed-carrier double-sideband signal is applied to the device to be measured, in which means are provided for sampling the signal at both input and output. The other part of the signal-generator output is fed through a calibrated phase shifter and applied to a crystal detector, to which the signal samples are then applied successively, the phase shifter being in each case adjusted for minimum a.f. signal in the detector output. The difference between the two settings of the phase shifter gives the phase difference between the two samples. Compensation for amplitude inequalities of the two samples is thus unnecessary.

612.317.7.087/.088 **2561**

Frequency Response Characteristics of Recording Instruments.—T. D. Graybeal. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 755–766.) Methods are discussed for determining the errors due to the dynamic limitations of instrument movements, and which appear in records. The a.c. steady-state response may be obtained by means of charts, given the undamped natural frequency and the relative damping. Test procedure is described for finding these two basic constants of a particular instrument. The importance of proper damping is emphasized; techniques are suggested whereby the frequency response may be made even better than that obtainable with optimum damping. A simplified analysis of servo-actuated recorders is included. Numerical examples are given.

621.317.71 **2562**

An Automatic Current Integrator.—Poole. (*See* 2455.)

621.317.72 : 621.396.645 **2563**

D.C. Amplifier Stabilized for Zero and Gain.—A. J. Williams, Jr, R. E. Tarpley & W. R. Clark. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 47–57.) An amplifier for d.c. measurements is described in detail. The zero is stabilized by means of a d.c./a.c. converter vibrating at 60 c/s. The overall voltage gain is about 40×10^6. Great care is taken to ensure that no unwanted 60-c/s component can affect the zero. Gain is stabilized within a small fraction of 1% by the use of overall d.c. feedback. Circuits are described for various measurements involving voltages of the order of $0.05\ \mu$V.

621.317.726 : 621.319.4 **2564**

A Wide-Range Variable Capacitor.—G. W. Bowdler. (*J. sci. Instrum.*, April 1949, Vol. 26, No. 4, pp. 117–119.) Description of a 3-terminal capacitor covering the range 0.01–10 pF. With a pair of Si rectifiers and a d.c. measuring instrument, it can be used as a r.f. peak voltmeter for the range 1–20 kV at frequencies from 50 kc/s to 50 Mc/s.

621.317.733 : 621.317.794 **2565**

A Direct Reading D.C. Bridge for Microwave Power Measurements.—H. J. Carlin & J. Blass. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 311–315.) A self-contained balanced bolometer bridge circuit suitable for field work is described in detail. The bridge uses two bolometer elements, a Wollaston wire for the range 0–1 mW and a metallized-glass element for the range 10–100 mW. The design of a built-in attenuator with a range of 0.03–3 db and maximum error 2.0% is discussed.

621.317.733.029.64 **2566**

A Microwave Impedance Bridge.—M. Chodorow, E. L. Ginzton & F. Kane. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, pp. 634–639.) A symmetrical 6-arm waveguide structure is described and its equivalent circuit is analysed theoretically. The relation between the admittances of the various arms is exactly that of a Wheatstone bridge with shunting susceptances across each pair of terminals. A device of this sort for use at a wavelength of 10 cm has been found to behave as predicted.

With this bridge any impedance can be measured to about the same accuracy as with a standing-wave detector. The standard impedances required are three variable reactances (movable shorting plungers) and a Z_0 termination. The positions of the plungers are measured. The device can be used as a 4-terminal lattice section for filter design or other applications; greater flexibility is obtained than with conventional T or Π sections.

621.317.74.029.64 **2567**

Microwave Slotted Sections.—S. A. Johnson. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 222–232.) Instruments used to measure the magnitude and phase of standing waves in a transmission line or waveguide without introducing appreciable field disturbance. The electrical impedance of the line can be deduced. High mechanical precision is required in the construction of the slotted sections. Sections for use at frequencies up to 75 kMc/s are described. Tuners for matching the probe of the detector are considered.

621.317.755 **2568**

A Cathode-Ray Oscillograph with 100-Megacycle Bandwidth.—M. M. Newman, R. P. Featherstone & P. S. Christaldi. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, p. 445.) Summary only.

621.317.755 : 621.317.791 **2569**

A Polar Vector Indicator.—A. H. Waynick, P. G. Sulzer & E. A. Walker. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 279–286.) An electronic device for demonstration purposes, which displays and permits determination of the magnitudes and phase angles of as many as three voltages or currents of the same frequency. Frequency range is 15–300 c/s, amplitude accuracy within ± 10%, phase accuracy within ± 3°.

621.317.761 **2570**

Contribution to the Technique of 'Dense' Standard-Frequency Spectra.—H. J. Griese. (*Fernmeldetech. Z.*, June 1949, Vol. 2, No. 6, pp. 179–188.) The term 'dense' is applied to spectra whose components are so close together in frequency that they can be separated from one another by means of simple electrical circuits and filters. Special technique is required in applications involving such spectra. Methods of generating dense spectra by the use of d.c. and a.c. pulses, and arrangements for frequency multiplication and for pulse modulation are described. Special equipment discussed includes (*a*) a generator providing standard frequencies at 10-kc/s intervals, with stronger signals at 100-kc/s intervals, for the calibration of receivers, (*b*) an interpolation frequency-meter, (*c*) a direct-reading frequency-meter, (*d*) apparatus for frequency stabilization, including a unit using a phase bridge. Direct and indirect methods of selecting a particular frequency from a dense frequency spectrum are also described.

621.317.772 : 621.396.67 **2571**

Measurement of the Phase of Radiation from Antennas.—J. N. Hines & C. H. Boehnker. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 487–495.) The equipment described consists of a signal generator, attenuator, probe aerial, a T-junction mixer and receiving apparatus. Two signals are introduced into the T-junction which combine if in phase and cancel if out of phase. Phase contours thus measured for various aerials are shown. Prediction of amplitude and phase patterns of arrays by combining vectorially the patterns of individual aerials is discussed.

621.317.784.087.44 **2572**

A Square-Law Power-Level Recorder.—W. R. Clark, W. R. Turner & A. J. Williams, Jr. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 132–146.) A recorder with a linear 40-db scale above a datum level of 0.000 2 mW. The error is less than 0.1 db between 20 c/s and 200 kc/s. The operation of the recorder is described. See also 488 of 1941 (Clark).

621.317.79 : 621.396.615 : 621-526 **2573**

Signal Generators for Servo System Measurements.—C. F. White. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 59–71.)

621.317.79 : 621.396.615 : 621.396.619.11 **2574**

A Low-Distortion A.M. Signal Generator.—E. S. Sampson. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 147–157.) Special features are (*a*) the modulator, which uses a.f. detection and feedback in the cathode circuit, (*b*) the cancellation amplifier, (*c*) the output amplifier, which includes a broad-band r.f. transformer, (*d*) the exalted-carrier detector. A.f. distortion is $<0.1\%$ at 100% modulation.

621.317.79 : 621.396.615 : 621.396.93 **2575**

Radio Direction Finder System Analyzer.—E. C. Jordan & J. J. Meyers. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 462–471.) A test device consisting of a 175-kc/s signal source, which can be suitably modulated, and various phase-shifters for simulating the voltages appearing at the aerial terminals of any d.f. array. The present analyser can simulate the effects of two rays arriving at an 8-element d.f. array. Its use reduces the time required for the analysis of d.f. systems, both old and new, and it could be useful for training purposes.

621.317.79 : 621.396.615.14 **2576**

A Broad-Band Signal Generator.—T. P. Hahn, J. Ebert & W. A. Lynch. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 316–320.) Design problems are discussed. Three internal-cavity reflex klystrons are used to cover the frequency range 4 000–10 000 Mc/s. Attenuator and wavemeter designs in coaxial r.f. cable are considered, as well as attenuator calibration and accuracy of power measurement. The method of applying impulses to the klystrons is described, with emphasis on ways of obtaining very short rise and decay times.

621.317.79 : 621.396.813 **2577**

A Simple Method for Determining Distortion Factors.—F. Enkel. (*Fernmeldetech. Z.*, May 1949, Vol. 2, No. 5, pp. 153–154.) A signal of frequency 800 c/s is applied to the system to be tested and the amplitude of the second and third harmonic in the output is measured, using in succession band filters tuned to 1 600 c/s and 2 400 c/s. The nonlinear distortion can then be calculated from simple formulae which are given. Curves show the variation of the quadratic and cubic terms of the distortion factor determined for (*a*) a triode amplifier, (*b*) a pentode amplifier, and (*c*) a magnetophon, as a function of the loading.

621.396.662(083.74) **2578**

A Standard of Attenuation for Microwave Measurements.—R. E. Grantham & J. J. Freeman. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 329–335.) Full paper; long summary abstracted in 1730 of June.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.717.1 : 621.386 **2579**

An X-Ray Thickness Gauge for Hot-Strip Rolling Mills.—C. W. Clapp & R. V. Pohl. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 620–626.)

531.717.1 : 621.386 **2580**

X-Ray Thickness Gauge for Cold-Rolled Strip Steel.—W. N. Lundahl. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 83–90.) One photomultiplier pickup and two X-ray sources are used. Range is 5–50 mil; accuracy within 1%.

536.58 : 621.316.7 **2581**

Precision Photoelectric Control of High-Temperature Furnaces.—F. C. Todd. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 289–297.)

539.16.08 **2582**

The Scintillation Counter.—J. W. Coltman. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, pp. 671–682.) A review of present knowledge regarding characteristics and operation of this type of counter.

539.16.08 **2583**

Accurate Determination of the Deadtime and Recovery Characteristics of Geiger-Müller Counters.—L. Costrell. (*Bur. Stand. J. Res.*, March 1949, Vol. 42, No. 3, pp. 241–249.) The relevant theory is briefly discussed. An electronic gating instrument for the determination of deadtime and recovery time within 1% or $2\ \mu s$ is described. The variation of these times with counter pressure and overvoltage is shown graphically.

539.16.08 : 548.0 : 537 **2584**

Crystal Counters : Parts 1 & 2.—Hofstadter. (*See* 2506 and 2507.)

539.16.08 : 621.318.572 **2585**

An Improved Quench Circuit for Geiger Counters.—Cooke-Yarborough, Florida & Davey. (*See* 2457.)

551.508.5 : 621.396.645.371 **2586**

Application of a D.C. Negative-Feedback Amplifier to Compensate for the Thermal Lag of a Hot-Wire Anemometer.—P. G. Hubbard. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 171–178.) Description of an instrument for measuring the instantaneous velocity of the air in wind tunnels, ducts, or free jets where small size and a very small time constant are essential. The use of feedback results in simple construction, improved stability and greater freedom from undesirable noise and oscillations.

615.849 **2587**

F.C.C. Diathermy Design for Low Harmonic Radiation and Good Frequency Stability.—E. W. Chapin, W. K. Roberts & M. C. Mobley. (*Trans. Amer. Inst. elect. Engrs,* 1948, Vol. 67, Part 1, pp. 42–46. Discussion, p. 46.)

621.317.083.7 **2588**

A Faster Telemeter for Carrier-Current Channels.—E. E. Lynch, H. C. Thomas & G. S. Lunge. (*Trans. Amer. Inst. elect. Engrs,* 1948, Vol. 67, Part 1, pp. 288–294. Discussion, p. 294.) A current of frequency between 6 and 27 c/s and directly proportional to the quantity to be measured is used to modulate carrier-current channels of conventional fixed-frequency types. The apparatus used is fully described, and compared with existing systems. Advantages claimed are: instantaneous response without overshoot, a high degree of accuracy and stability, absence of contacts and a minimum number of moving parts.

621.317.79 : [531.787.9 + 531.718.4 **2589**

Electronic Methods for Measurement of Pressure and Displacement.—A. Crossley & D. L. Elam. (*Proc. nat. Electronics Conference, Chicago,* 1948, Vol. 4, pp. 158–170.) Description of (*a*) the Pressuregraph-Syncromarker, for measuring static or dynamic pressures in a chamber containing fluid or gas, (*b*) the Dynamic Micrometer, which measures movement of vibrating metal bodies within ± 0.1 mil. See also 3214 of 1947.

621.365.003.12 **2590**

Some Economic Aspects of Radio-Frequency Heating.—L. M. Duryee. (*Trans. Amer. Inst. elect. Engrs,* 1948, Vol. 67, Part 1, pp.105–112.)

621.38.001.8 **2591**

Digests of Papers at Conference on Electron Tubes in Industry.—(*Elect. Engng, N.Y.,* June 1949, Vol. 68, No. 6, pp. 525–529.) Summaries of most of the papers presented at the A.I.E.E. conference on the Industrial Application of Electron Tubes, Buffalo, N.Y., 11th–12th April 1949.

621.38.001.8 : 681.9 **2592**

Fairchild Electronic Half-Tone Engraving Machine.—J. Boyajean. (*Proc. nat. Electronics Conference, Chicago,* 1948, Vol. 4, pp. 330–336.)

621.383.001.8 **2593**

Research on Reading Aids for the Blind.—V. K. Zworykin, L. E. Flory & W. S. Pike. (*J. Franklin Inst.,* May 1949, Vol. 247, No. 5, pp. 483–496.) Discussion of the system already mentioned in 3700 of 1946 and 3229 of 1947. An electronic method of letter recognition is also considered. Results so far achieved, while not spectacularly successful, indicate possible approaches to the problem.

621.384.611.2† **2594**

A 70-MeV Synchrotron.—F. R. Elder, A. M. Gurewitsch, R. V. Langmuir & H. C. Pollock. (*J. appl. Phys.,* Sept. 1947, Vol. 18, No. 9, pp. 810–818.)

621.384.62† **2595**

The Design of Linear Accelerators.—J. C. Slater. (*Rev. mod. Phys.,* July 1948, Vol. 20, No. 3, pp. 473–518.) The relative merits of linear and orbital accelerators are discussed. The phase velocity in a waveguide can be reduced by loading so that the waves travel with the same speed as that of the particles to be accelerated. The loaded guide has band-pass filter characteristics. Formulae are derived for the amplitude of the accelerating field in standing-wave and travelling-wave accelerators respectively. The distance between successive feeds to the guide must not exceed the attenuation length, or distance in which the energy density of a travelling wave falls to $1/e$ of its initial value. Geometrical factors affecting acceleration are discussed. Group velocity is less than phase velocity; it is theoretically zero for the π-mode tube used in the M.I.T. accelerator, which has small attenuation length. The feeding of power into linear accelerators, tolerances in long accelerators, and particle dynamics for different types of accelerator, are considered.

621.385.832 : [535+77 **2596**

Cathode-Ray Tube Applications in Photography and Optics.—C. Berkley & R. Feldt. (*Proc. nat. Electronics Conference, Chicago,* 1948, Vol. 4, p. 314.) Summary only.

621.385.833 **2597**

On the Calculation, for an Immersion Objective with Axial Symmetry, of the Potential along the Axis and of its Derivatives.—M. Duchesne. (*C. R. Acad. Sci., Paris,* 2nd May 1949, Vol. 228, No. 18, pp. 1407–1408.) The results of calculations for the objective of an electron telescope are in good agreement with values determined experimentally, using an electrolyte tank.

621.385.833 **2598**

Use of the Electron Microscope in the Optical Industry.—J. Robillard. (*Rev. d'Optique,* March 1949, Vol. 28, No. 3, pp. 129–145.) General discussion, with special reference to investigation of the characteristics of antireflection layers.

621.385.833 : 537.133 **2599**

The Proton Microscope.—C. Magnan. (*Nucleonics,* April 1949, Vol. 4, No. 4, pp. 52–66.) Aberrations are shown to limit the maximum theoretical resolving powers of optical, e.s. and e.m. electron microscopes to 170 mμ, 2.5 mμ and 1 mμ respectively.

At the Collège de France, an e.s. electron microscope is being converted to an e.s. proton microscope. Suitable proton sources, lens systems and object carriers are described. The maximum theoretical resolving power is 0.15 mμ. With photographic enlargement a total magnification of 600 000 is expected.

621.386 : 621.396.9 **2600**

The Application of Radar Techniques to a System for High-Speed X-Ray Motion Pictures.—D. C. Dickson, Jr, C. T. Zavales & L. F. Ehrke. (*Proc. nat. Electronics Conference, Chicago,* 1948, Vol. 4, pp. 298–313.)

621.391.63 : 526.9 **2601**

An Optical Radar for Surveying.—W. W. Hansen. (*Trans. Amer. Inst. elect. Engrs,* 1948, Vol. 67, Part 1, pp. 660–663.) For another account see 3211 of 1948.

PROPAGATION OF WAVES

538.56 **2602**

The Approximate Solution of One-Dimensional Wave Equations.—C. Eckart. (*Rev. mod. Phys.,* April 1948, Vol. 20, No. 2, pp. 399–417.) A general discussion, in terms of Hamiltonian functions, of the type of differential equation applicable to waves on a stretched string, sound waves in a tube of uniform cross-section, the propagation of electric currents along a uniform wire etc. The Fourier solution of the initial-value problem, group and phase velocity, the resolution of waves into spectra, wave fronts and unresolved waves are considered. Particular attention is given to the method of stationary phase, which is the mathematical foundation for the Hamilton-Jacobi ray theory. Difficulties in the application of this method to a dissipative medium are considered but no definite conclusions are reached.

538.566 **2603**

On Sommerfeld's "Radiation Condition".—F. V. Atkinson. (*Phil. Mag.*, June 1949, Vol. 40, No. 305, pp. 645–651.) Discussion of the uniqueness of solution in problems of wave motion involving an infinite medium. A set of conditions is formulated under which the solution is proved to be unique; these include Sommerfeld's 'condition of finiteness' as well as his 'radiation condition'.

538.566 **2604**

On the Propagation of Electromagnetic Waves in Stratified Media.—F. Abelès. (*Ann. Phys., Paris*, July/Aug. 1948, Vol. 3, pp. 504–520.) The media are assumed to be composed of many homogeneous isotropic layers bounded by parallel planes; the e.m. waves are plane and sinusoidal, with any orientation whatever. The problem resolves into that of determining the constants of integration for Maxwell's equations so as to satisfy the conditions at the limits. A system of $2p$ linear equations with $2p$ unknowns has thus to be solved; this is effected by means of recurrence formulae. The relation between the physical and mathematical aspects of the problem is stressed. Formulae are derived by summation of the rays reflected an odd number of times and explicit expressions are given for the complex coefficients of reflection and transmission for a stratified medium. From these coefficients, information concerning the effects of such a medium on a plane incident wave is easily deduced. Three general theorems are enunciated and briefly discussed.

538.566 : 551.510.52 **2605**

On the Internal Reflection of Electromagnetic Waves in a Stratified Medium. Application to the Troposphere.—G. Eckart & T. Kahan. (*C. R. Acad. Sci., Paris*, 25th April 1949, Vol. 228, No. 17, pp. 1373–1374.) Discussion of reflection due solely to the inhomogeneity of the medium and not to a discontinuity in the values of ϵ and μ. The reflection coefficient for the stratified troposphere is calculated and shown to be proportional to λ. It appears improbable that this type of reflection can be observed with e.m. waves in the case of the troposphere, but since the variation of the acoustic characteristics in the troposphere is much greater than that of the values of ϵ and μ, acoustic experiments might be more successful.

621.396.11 : 551.510.535 **2606**

The Analysis of Ionospheric Reflections: Part 2.—A. H. de Voogt. (*Tijdschr. ned. Radiogenoot.*, May 1949, Vol. 14, No. 3, pp. 73–85. In English.) Polarization curves for different collision frequencies are given, together with hypothetical curves for electron-density distribution and collision frequency during the daytime and in the evening. Path times are derived for positive and for negative pulses. Discussion of attenuation leads to the view that recently published values of the collision frequency are too high and that the greater part of the friction loss occurs in the E-layer, or even the D-layer. Results obtained with twin-loop receiving equipment 1 600 m from a 2-kW transmitter are described. Signals with circular polarization gave the best results, though even these were subject to fading during evening periods. Part 1, for which corrections are given, 1381 of May.

621.396.11 : 551.510.535 **2607**

Deviation at Vertical Incidence in the Ionosphere.—M. Cotte: G. Millington. (*Nature, Lond.*, 21st May 1949, Vol. 163, No. 4151, p. 810.) Comment on 1763 of June, and the author's reply.

621.396.11 (98) **2608**

Short-Wave Propagation over the Polar Regions.—H. A. Hess. (*Elektron Wiss. Tech.*, June 1949, Vol. 3, No. 6, pp. 218–226.) An account of results obtained at Frederikshavn during the period 1942–1945. Records were obtained, on quickly moving film, of direct and reverse signals from various distant stations. In some cases the transmission path included both the north and south polar zones. The split signals observed for transmission paths near the poles can be explained by interference between two or more waves of slightly different frequency due to a Doppler effect. When two waves of nearly equal amplitude are concerned a pronounced beat minimum is obtained. The observed Doppler frequency shift of 5–30 c/s at frequencies between 10 Mc/s and 20 Mc/s indicates large movement of the reflecting layer in the polar zone.

621.396.812 **2609**

Atmospheric Effects on Short-Wave Radio Propagation.—J. S. McPetrie & B. J. Starkey. (*Nature, Lond.*, 18th June 1949, Vol. 163, No. 4155, pp. 958–959.) The low-level atmospheric ducts discussed in 1167 of April (McPetrie & Starnecki) have little effect on the propagation of centimetre waves when the transmitter or the receiver is well above the duct, or on the propagation of metre waves for any height of transmitter or receiver. Experimental results supporting this are shown graphically and discussed.

621.396.812.3.029.64 **2610**

Preliminary Analysis of Microwave Transmission Data Obtained on the San Diego Coast under Conditions of a Surface Duct.—C. L. Pekeris & M. E. Davis. (*J. appl. Phys.*, Sept. 1947, Vol. 18, No. 9, pp. 838–842.) Transmission data for 63 and 170 Mc/s are analysed by wave theory. Good agreement between theory and experiment was obtained for a range of 32 miles. Between 32 and 70 miles variations of intensity with height are as expected, but the theoretical horizontal decrement is less than that observed. Beyond about 80 miles the observed field tends to become uniform with height and shows little horizontal attenuation. See also 521 of 1948 (Katzin, Bauchman & Binnian).

621.396.812.4.029.6 **2611**

Tropospheric Effects in Ionosphere-Supported Radio Transmission.—G. W. Pickard & H. T. Stetson. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, pp. 596–599.) A statistical analysis of (*a*) night field strength at Newton Centre, Mass., due to 1 330-kc/s broadcast transmissions from WBBM, Chicago, 850 miles away, (*b*) reception at Needham of WWV 5-Mc/s, XEWW 9.5-Mc/s, WWV 10-Mc/s and W2XMN 44.1-Mc/s signals, for correlation with Boston weather data. Night field strength at Newton rises from a minimum one day before a temperature rise of 10°F to a maximum on the day of the rise. Similarly, a drop in field strength precedes an equal temperature fall. Night field strength of WWV 5-Mc/s transmissions tends to a maximum one day before a SE wind blows across the transmission path; such a wind is associated with temperature inversions. See also 1453 of 1948.

RECEPTION

621.396.621 **2612**

Extraction of Weak Signals from Noise by Integration.—H. Stockman, F. R. Dickey, Jr, & A. G. Emslie. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 102–120.) Fundamental relationships concerning the detection of weak signals are obtained without recourse to the usual mathematical methods. A system is described in which a l.f. mechanical filter interrupts the signal and gives about 24 db improvement in signal/noise ratio for an integration time of several minutes. Results obtained agree with theoretical calculations.

621.396.621 **2613**

Optimum Selectivity in Superregenerators.—D. Richman. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 121–131.) The selectivity of a superregenerator is determined by the variation of instantaneous sensitivity due to modulation of the resonator conductance during a quench cycle. For optimum selectivity a conductance waveform may be selected to give narrowest skirt selectivity, or the nose of the curve may be narrowed to a degree determined by the rejection required for signals outside the pass band.

621.396.621 **2614**

A Simple Far-Near Device for Radio Receivers.—H. Gibas. (*Bull. schweiz. elektrotech. Ver.*, 29th May 1948, Vol. 39, No. 11, pp. 362–367. In German.) An arrangement in which a band filter with feedback is used to increase the selectivity and sensitivity of a small receiver for the reception of signals from distant stations. The filter is short-circuited for local stations, giving a greater bandwidth and hence reception of better quality. The design of a suitable filter is discussed.

621.396.621 **2615**

A Method for Distortionless Demodulation of Single-Sideband Oscillations.—E. Meinel. (*Arch. elekt. Übertragung*, Feb. 1949, Vol. 3, No. 2, pp. 37–46.) The method is based on the fact that with quadratic rectification of single-sideband oscillations, only the first-order difference tones occur as nonlinear distortion, the amplitude of which is independent of the carrier amplitude. Since only the first-order difference tones remain after quadratic rectification of single-sideband oscillations without carrier, they can be completely eliminated in the compensation arrangement described, which consists of two symmetrical quadratic-rectifier receivers. The single-sideband oscillations with carrier are applied to one receiver and equal signals without carrier to the second receiver, the two outputs being applied in opposition in the common output circuit. Nonlinear distortion is thus eliminated so long as the modulation of the transmitter does not greatly exceed 50%. The method should have wide application in single-sideband technique, including multichannel cable communication, long-wave and medium-wave broadcasting, and television.

621.396.621 **2616**

Wideband Frequency Discriminator Design.—Rideout. (*See* 2483.)

621.396.621 **2617**

Performance Capabilities of Superregenerative Receivers.—G. V. Eltgroth. (*Tele-Tech*, Feb. & March 1949, Vol. 8, Nos. 2 & 3, pp. 24–27, 57 & 40–43, 71.) Analysis with particular reference to selectivity and fidelity characteristics, signal/noise ratio and optimum operation conditions.

621.396.621 : 621.396.82 **2618**

The Effect of Interference on Superregenerative Receivers.—L. S. Gutkin. (*Radiotekhnika, Moscow*, Jan./Feb. 1949, Vol. 4, No. 1, pp. 62–76. In Russian.) Continuation of 1738 of 1948. The effect of interference, consisting of single and repeated impulses, on the operation of a superregenerative receiver is investigated theoretically. The interference voltages at the output of the superregenerative circuit and of the l.f. amplifier, and the effect of nonlinear operating conditions are discussed. A superregenerative receiver possesses a higher degree of discrimination with respect to impulse interference than an ordinary receiver. A general summary is given of types of interference.

621.396.621 : 621.396.619.11/.13 **2619**

On Theoretical Signal-to-Noise Ratios in F.M. Receivers: A Comparison with Amplitude Modulation.—D. Middleton. (*J. appl. Phys.*, April 1949, Vol. 20, No. 4, pp. 334–351.) Signal/noise ratios at the output of a f.m. receiver are determined as functions of the input signal/noise ratio, clipping level and a.f. filter characteristics when random (fluctuation) noise accompanies the signal. Both narrow-band and broad-band f.m. are examined. Calculations are made for sinusoidal f.m. The concept of signal/noise ratio is redefined. Comparison is made with a.m. reception using a half-wave linear rectifier. For signals less than 3 db above noise, a.m. requires less input signal than f.m. for a given noise background and a given output. Only for signals at least 10 db above noise is f.m. superior to a.m. Broad-band f.m. with heavy limiting is required in this case. Narrow-band f.m., even with no limiting, is not better than a.m. at high signal levels. Limiting is detrimental for narrow-band operation, whereas it is essential for broad-band operation, in which case the shape of the i.f. response curve is important. Curves illustrating the average and mean-square signal and noise outputs, and signal/noise ratios for various conditions of operation, are included.

621.396.82 **2620**

Tolerable Mutual Interference of Two F.M. Broadcasting Transmitters.—T. J. Weijers. (*Tijdschr. ned. Radiogenoot.*, May 1949, Vol. 14, No. 3, pp. 61–72. In Dutch.) Selectivity measurements for three different f.m. receivers are shown graphically and discussed. Conclusions as to the relative strengths and frequency characteristics of signals from two neighbouring transmitters, consistent with satisfactory reception of the signals from one of them, are summarized.

621.396.82 : 537.523.3 **2621**

Corona Interference with Radio Reception in Aircraft.—M. M. Newman. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 91–95.) Oscillograms show typical corona pulses received on bare and on insulated aerials, and the serious effect of shock-excitation of both aerials and receiver circuits due to the sharp rate of rise of the pulses. Insulated aerials are recommended, but even for these serious interference can be caused by other bare aerials and by charges developed on various parts of the aircraft structure.

621.396.82 : 551.594 : 551.577 **2622**

The Effect of Air Speed upon Precipitation Charging of an Airplane.—H. J. Dana. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 96–101.) Charging rate varies as the cube of air-speed. This law was confirmed by experiment. Two types of discharger are briefly discussed.

621.396.822.029.63 **2623**

Impairment of Intelligibility by Noise in Decimetre-Wave Links.—E. Dietrich. (*Fernmeldetech. Z.*, June 1949, Vol. 2, No. 6, pp. 173–178.) Discussion of the various factors involved establishes that speech intelligibility suffers little reduction due to the circuit, multipath or other noises usually met with. Decimetre-wave links can thus provide a satisfactory means of communication even without noise suppression.

621.396.828 **2624**

Interference-Free Reception by means of Aerials with Screened Down-Leads.—W. Hormuth. (*Frequenz*, March 1949, Vol. 3, No. 3, pp. 61–73.) Description of equipment suitable for either private dwellings or apartment houses. Particular attention is given to earthing arrangements and distribution systems.

621.396.828 **2625**

Circuit Design for Reduction of Hum.—Dickerson. (*See* 2496.)

STATIONS AND COMMUNICATION SYSTEMS

621.391.63 : 534.321.9 : 535.61-15 **2626**

Ultrasonic Modulation of a Light Beam.—R. F. Humphreys, W. W. Watson & D. L. Woernley. (*J. appl. Phys.*, Sept. 1947, Vol. 18, No. 9, pp. 845–846.)

621.396(94) **2627**

Some Aspects of the Overseas Telecommunications Services Operated by the Overseas Telecommunications Commission, Australia.—A. S. McDonald. (*Proc. Instn Radio Engrs, Aust.*, April 1948, Vol. 9, No. 4, pp. 4–8. Discussion, pp. 8–9.) An outline is given of the formation and functions of the Commission. A review of the present facilities includes a reference to the overseas facsimile service. Equipment and techniques are briefly described.

621.396.41 : 621.396.619.16 **2628**

Terminal Equipment for Pulse-Time Multiplex.—A. M. Levine & D. D. Grieg. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, p. 131.) Summary only. Discussion of : (*a*) design of terminals using pulse-amplitude, pulse-time or pulse-count modulation, (*b*) methods of maintaining bandwidth while improving signal/noise ratio by adding cross-talk and distortion at the transmitting end and removing them at the receiver, (*c*) methods of establishing base rates and timing of the channels, (*d*) modulation circuits for timed channels, (*e*) methods of maintaining synchronism and framing, (*f*) channel selection and demodulation, (*f*) mechanical and electrical construction. A general description of various terminal units, with photographs, is included.

621.396.41.029.63 : 621.396.97 **2629**

Experimental Ultra-High-Frequency Multiplex Broadcasting System.—A. G. Kandoian & A. M. Levine. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, pp. 694–701.) An 8-channel high-fidelity system in which multiplex operation is achieved by time-sharing pulse-time modulation. The main components, including modulator, transmitter/aerial system and receiver, are described and their operating characteristics discussed.

621.396.44 : 621.315.052.63 **2630**

Operational Experience with Single-Sideband Power-Line Carrier Equipment.—F. S. Beale. (*Tele-Tech*, June 1949, Vol. 8, No. 6, pp. 32–35.) Single-sideband equipment is particularly useful under conditions of high circuit attenuation, high noise level, heterodyne interference, or where a limited frequency band is available.

621.396.619 **2631**

Contribution to the General Theory of Modulation and Demodulation for Any Type of Characteristic.—Heymann. (*See* 2482.)

621.396.619 : 621.396.61 **2632**

"Auto-Anode" Modulation for Radio Broadcasting Transmitters.—N. G. Kruglov. (*Radiotekhnika, Moscow*, March/April 1949, Vol. 4, No. 2, pp. 7–24. In Russian.) Description of a modulation system proposed by the author and now used at several broadcasting stations in the U.S.S.R. No high-power modulator is used, but certain valves which generate r.f. oscillations also serve for anode modulation. The r.f. output is not less than that obtained with the usual anode-modulation methods. The theory of the method is discussed and various practical circuits are suggested. The modulation efficiency is almost double that for grid modulation; an overall transmitter efficiency of 45% is possible.

621.396.619.13 **2633**

Some Developments in Frequency-Modulation Techniques.—D. A. Bell. (*Strowger J.*, April 1949, Vol. 6, No. 4, pp. 159–165.) Discussion with particular reference to signal/noise ratio, reactance-valve f.m., relaxation oscillators, and counter circuits as frequency detectors. Simple and compact equipment for a 6-channel system is described briefly; this can be used with either cable or radio links.

621.396.619.13 : 621.396.029.58 **2634**

On the Application of Frequency Modulation in Short-Wave Radio Technique.—H. J. Griese. (*Fernmeldetech. Z.*, May 1949, Vol. 2, No. 5, pp. 141–146.) Bandwidth and signal/noise characteristics for a.m. and f.m., distortion due to multipath transmissions, and fading effects are discussed. The principles of a phase-shift keying system are explained.

621.396.619.13 : 621.396.611.3 **2635**

The Application of Coupled Systems with Distributed Constants to Frequency Modulation in the Ultra-High-Frequency Range.—Tolstikov. (*See* 2475.)

621.396.619.16 **2636**

Pulse Modulation.—E. M. Deloraine. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, pp. 702–705.) A general review of various types of pulse modulation. Applications to time-division multi-channel systems and to switching problems are discussed.

621.396.65 : 621.396.3 **2637**

A 150-kc/s Carrier System for Radio Relay Applications.—J. E. Boughtwood. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 577–582.) Developed by the Western Union Telegraph Co. 32 voice-band communication channels, each 3 000 c/s wide, are derived in the frequency range 4–147 kc/s. Tandem stages of group modulators maintain high spectrum efficiency without crystal filters. A crystal-controlled harmonic carrier supply ensures the frequency stability required by narrow-band f.m. telegraph circuits. See also 2471 above.

621.396.97 : 621.396.619.13 **2638**

Frequency-Modulation Broadcasting.—A. J. McKenzie. (*Proc. Instn Radio Engrs, Aust.*, May 1948, Vol. 9, No. 5, pp. 4–16. Discussion, pp. 16–17.) A general review, with particular reference to experimental transmissions from Melbourne and Sydney. Various types of transmitter and typical methods of producing f.m. waves are discussed. Conventional aerial systems used in f.m. broadcasting are described and their performances are compared.

621.396.97 (43) **2639**

Twenty-Five Years of Broadcasting in Germany.—A. Heilmann. (*Fernmeldetech. Z.*, May 1949, Vol. 2, No. 5, pp. 129–134.) A review of technical developments.

SUBSIDIARY APPARATUS

621-526 **2640**

Evaluating Servomechanisms Performance.—G. M. Attura. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 72–90.)

621-526 **2641**

Electronic Circuits for Control of Clutch-Type Servomechanisms.—F. E. Edwards, Jr. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 54–58.) Brief description of clutch-type servomechanisms and desirable control-circuit characteristics, with details of a circuit of minimum time-lag and good stability.

621-526 : 621.317.79 : 621.396.615 **2642**

Signal Generators for Servo System Measurements.—C. F. White. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 59–71.)

621.3.027.3 : 621.316.722 **2643**

A 500-50 000-Volt Regulated Power Supply.—R. E. Anderson. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 315–329.) Discussion of a continuously variable d.c. supply unit with a maximum load current of 1 mA. A Hartley oscillator giving a frequency of about 40 kc/s is used with a voltage-tripler circuit. Two regulating loops in series maintain the output voltage constant within 0.2%; one loop serves to control the screen-grid voltage of the r.f. amplifier valves and the other to control the d.c. output through a d.c. amplifier and series regulating valve. The primary reference voltage is a thermally insulated battery from which no current is drawn.

621.314.63 **2644**

A Practical Approach to Calculating Optimum Performance of Semiconductor Rectifiers.—Wilson. (*See* 2452.)

621.314.632 **2645**

Twenty-Five Years of Copper/Copper-Oxide Rectifiers.—L. O. Grondahl. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 403–410.)

621.316.726 **2646**

Electronic Voltage Regulator for Control of Generators.—W. J. R. Farmer. (*Elect. Times*, 16th June 1949, Vol. 115, No. 3006, pp. 803–806.) The advantages of such regulators are discussed and the general principles of a standard type are explained.

TELEVISION AND PHOTOTELEGRAPHY

621.397.24 : 621.394 **2647**

Western Union Teletape Facsimile.—L. G. Pollard. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 511–515.)

621.397.331.2 **2648**

Cathode-Ray Tubes for Television. Operating Conditions *v*. Picture Brightness.—H. Moss. (*Wireless World*, June & July 1949, Vol. 55, Nos. 6 & 7, pp. 202–205 & 261–263.) Discussion of (*a*) the increase of c.r. tube voltage required to maintain constant brightness as the screen diameter is increased, assuming constant resolution at the screen, constant spot size and constant number of lines, (*b*) the increase of tube voltage to maintain constant brightness as the number of scanning lines is increased, the frame frequency being unchanged.

621.397.335 **2649**

The Locked Oscillator in Television Reception.—K. Schlesinger. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 337–350.) Synchronization by amplitude separation of timing and picture signals does not always offer adequate noise protection. Conditions can be improved by using high-Q circuits to select a narrow spectrum around the line-scanning frequency. The number of lines effectively linked in phase is increased by using a locked oscillator tuned to the average line frequency and directly synchronized by the signal input. Q is thus increased by regeneration. Theoretical potentialities of such systems are indicated and a successful practical solution is discussed.

621.397.5 : 535.88 **2650**

An Improved Schmidt Plate.—D. B. G. Hawkins. (*Phil. Mag.*, June 1949, Vol. 40, No. 305, pp. 670–679.) The profile of an improved aspherical plate is calculated which minimizes the off-axis errors of Schmidt cameras over a given field. The colour error is small compared with the off-axis errors for wide angular fields.

621.397.5 : 535.88 **2651**

Large-Screen Television.—R. V. Little, Jr. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 352–361.) Discussion of the basic elements of the direct-viewing system and the intermediate-film system.

621.397.5 : 535.88 **2652**

Demonstration of Large-Screen Television at Philadelphia.—R. Wilcox & H. J. Schlafly. (*J. Soc. Mot. Pict. Engrs*, May 1949, Vol. 52, No. 5, pp. 549–560.) A description of experiments with R.C.A. equipment in the Fox-Philadelphia theatre, June 1948. Screen brightness was increased by use of a c.r. tube voltage of 80 kV and an aluminized screen with controlled directional characteristics.

621.397.5 : 535.88 : 791.45 **2653**

Theater Television System.—R. Hodgson. (*J. Soc. Mot. Pict. Engrs*, May 1949, Vol. 52, No. 5, pp. 540–548.) A review of the development and performance of the intermediate-film method adopted by Paramount Pictures.

621.397.6 : 621.385.832 **2654**

Mass-Production Techniques for Television Kinescopes.—D. Y. Smith. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, p. 186.) Summary only.

621.397.6 : 778.3 **2655**

Video Recording Technics.—G. H. Gordon. (*Tele-Tech*, May & June 1949, Vol. 8, Nos. 5 & 6, pp. 31–33 .. 63 & 29–31 .. 55.) A detailed description of equipment using 16-mm film for photographing direct from a television c.r. tube. Film speed is 24 frames per sec. The arrangements for conversion from the standard American television rate of 30 frames per sec are discussed. Standard films are satisfactory.

621.397.61 **2656**

Experimental Transmitting and Receiving Equipment for High-Speed Facsimile Transmission: Part 2 — Details of the Transmitter.—D. Kleis, F. C. W. Slooff & J. M. Unk. (*Philips tech. Rev.*, March 1949, Vol. 10, No. 9, pp. 257–264.) Part 1, 2338 of August. Part 3, 2657 below.

621.397.62 **2657**

Experimental Transmitting and Receiving Equipment for High-Speed Facsimile Transmission: Part 3 — Details of the Receiver.—F. C. W. Slooff, M. van Tol & J. M. Unk. (*Philips tech. Rev.*, March 1949, Vol. 10, No. 9, pp. 265–272.) Part 2, 2656 above.

621.397.62 **2658**

New Television Receiver without Transformers. Design with Interchangeable Units.—R. Aschen. (*T.S.F. pour Tous*, April–Aug. 1949, Vol. 25, Nos. 246–250, pp. 129–133, 169–173, 205–212 & 244–246.) Detailed description of a receiver comprising four units, each with its own power supply. Interaction between the four units can easily be avoided by operating them sufficiently far apart and any unit can be changed without affecting the others. The units are respectively (*a*) video receiver, (*b*) sound receiver, (*c*) time-base unit, (*d*) 7-kV supply unit for the c.r. tube. Stagger tuning is used in the video circuit and blocking oscillators in the line and image timebases. Detailed circuit diagrams are given in all cases. Pertinent circuit formulae and timebase refinements are discussed in an appendix.

TRANSMISSION

621.392.53 : 621.396.645 **2659**

Investigations on Path-Time Distortion in Carrier-Frequency Amplifiers.—Schaffstein. (*See* 2494.)

621.394.61 : 621.396.029.52 **2660**

Valve Loading and Signal Shape for Slightly Damped Long-Wave Telegraphy Transmitters.—A. Ruhrmann. (*Fernmeldetech. Z.*, May 1949, Vol. 2, No. 5, pp. 147–152.) The effect of the loading of the transmitter output valve on the signal shape is discussed. A considerable improvement in signal shape can be effected by the use of feedback. Transmitter operation is considered by reference to the equivalent circuit and the characteristics of 2-stage and 3-stage transmitters are discussed. The latter have definite practical advantages.

VALVES AND THERMIONICS

621.3.015.3 : 621.385 **2661**

The Surge Testing of High-Vacuum Tubes.—H. J. Dailey. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 187–199.) A method for initiating flash arcs and the results of such arcs under various conditions are described. Damage is a function of valve gas pressure, electrode configuration and arc current. Suggestions are made for minimizing arc effects.

621.385 **2662**

Operating Conditions for the Optimum Working of Output Valves in High-Power Broadcast Amplifiers.—N. L. Bezladnov. (*Radiotekhnika, Moscow*, Jan./Feb. 1949, Vol. 4, No. 1, pp. 5–15. In Russian.) The optimum working of a valve is secured when ξ, k and A tend simultaneously to unity, where ξ is the ratio of peak voltage swing to steady anode voltage, k is the ratio of maximum anode current to saturation current and A is the ratio of maximum anode current to permissible anode dissipation. Each of these conditions is examined separately and the necessary valve parameters and operating conditions for satisfying them are discussed. Practical suggestions are given.

621.385 **2663**

Trends in Electron Tube Design.—W. C. White. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 796–808.) See 1827 of June.

621.385-713 **2664**

A Transmitting Valve Cooler with Increased Turbulence of the Cooling Water.—M. J. Snijders. (*Philips tech. Rev.*, Feb. 1949, Vol. 10, No. 8, pp. 239–246.) Details of a cooling system using rings of jets round the anodes of high-power valves.

621.385.029.62 **2665**

Glass Transmitting Valves of High Efficiency in the 100-Mc/s Range.—E. G. Dorgelo. (*Philips tech. Rev.*, March 1949, Vol. 10, No. 9, pp. 273–281.) Reasons for preferring a coaxial cylindrical construction are given. Special features include a spiral cathode of thoriated tungsten, a non-emissive grid, a graphite anode with horizontal cooling fins and shaped like a cotton reel, and a shield to reduce the temperature of the lower part of the all-glass envelope. In the triodes, the shield is connected to the grid, so that the valves can be used in grounded-grid circuits without neutrodyning even at 200 Mc/s. In the tetrodes, the shield is connected to the screen-grid and neutrodyning is necessary only above about 100 Mc/s. Details are given of the triode TB 2.5/300 and the tetrode QB 2.5/250, with anode dissipations of 135 W and 125 W respectively and an efficiency of 65–70% at 100 Mc/s. Larger valves, with dissipation up to 540 W, are in course of development.

621.385.029.63/.64 **2666**

On the Propagation of Waves along a Coaxial Spiral Line in the Presence of an Electron Beam.—L. N. Loshakov. (*Zh. tekh. Fiz.*, May 1949, Vol. 19, No. 5, pp. 578–595. In Russian.) A mathematical analysis. The inner conductor of the line is of spiral form. The problem was solved in a general way by the use of equivalent circuits by Pierce (2284 of 1947) and Bernier (4066 of 1947). Here a specific retardation system—the spiral line—is considered, which for centimetre waves is apparently the most suitable. From Maxwell's equations and an equation of electron travel, expressions are derived determining the field structure of waves propagated in the line. A particular case is discussed.

621.385.029.63/.64 **2667**

A Periodic-Waveguide Traveling-Wave Amplifier for Medium Powers.—G. C. Dewey. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, p. 253.) Summary only. The most successful waveguide for use as a power amplifier, with the best gain and bandwidth characteristics and propagating a useful slow mode, is singly corrugated coaxial transmission line with the corrugations on the inner conductor. Such an amplifier has been built giving 10 db gain at 40 W output and a bandwidth at 4 600 Mc/s of 70 Mc/s between 3-db points. Results confirm theory to a marked degree and suggest that even better results are possible. The tube appears to be capable of 100 times the power output of the Pierce helix-type travelling-wave amplifier at any frequency.

621.385.029.63/.64 **2668**

A Note on Filter-Type Traveling-Wave Amplifiers.—J. R. Pierce & N. Wax. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, pp. 622–625.) Small-signal analysis of systems in which an electron beam interacts with a circuit composed of discrete filter elements. The interaction between a line beam and a series of gaps, which are capacitive elements of a filter structure, is discussed. An admittance arising from the presence of the electrons can be introduced, which is in parallel with the gap capacitance and will thus alter the propagation factor of the filter circuit. Travelling-wave solutions exist for the combination of electron beam and filter circuit; there is a solution with a positive real part, indicating that amplification will occur.

621.385.029.63/.64 **2669**

On the Mode of Operation of the Travelling-Wave Valve.—O. Döhler & W. Kleen. (*Arch. elekt. Übertragung*, Feb. & March 1949, Vol. 3, Nos. 2 & 3, pp. 54–63 & 93–100.) The construction and operation of such valves are briefly discussed. The power gain is of the order of 20 db. The bandwidth may exceed 100 Mc/s. Approximate calculations indicate that the overall efficiency of the valve cannot exceed a few per cent. The theory for large signals shows that with present technique the maximum power that can be handled is only 0.5–1 W. Discussion of space-charge effects explains the difference between measured values of amplification and values calculated without taking account of space-charge effects. See also 250 and 251 of January and 2089 of July.

621.385.032.21 **2670**

Alkali-Metal Alloys for Cathodes of Power Electronic Tubes.—J. A. M. Lyon & C. E. Williams. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 179–185.) An account of experiments with sodium-amalgam and potassium-amalgam cathodes in glass and in metal envelopes. A potassium-amalgam valve is described which operated satisfactorily in an inverted position for about half an hour.

621.385.032.216 **2671**

Pulse Emission Decay Phenomenon in Oxide-Coated Cathodes.—G. R. Feaster. (*J. appl. Phys.*, April 1949, Vol. 20, No. 4, pp. 415–416.) The cathode fatigue effect which sometimes occurs during high-power pulse emission from BaO-SrO cathodes is ascribed to poisoning. Experimental evidence of this is discussed. The decay is only obtained when electrons bombard a portion of the anode containing a poisoning agent. The question whether oxygen can cause the decay is being investigated.

621.385.2 : 537.525.92 **2672**

Note on Space-Charge Considerations in Test-Diode Design.—E. A. Coomes & J. G. Buck. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, pp. 626–627.) For test diodes of axial symmetry, the minimum variation in the slope of the space-charge line for small variations in the anode radius r_a and cathode radius r_c occurs when $r_a/r_c = 3.16$.

621.385.2 : 621.396.822 **2673**

Current Fluctuations in a Plane Diode, taking account of Space Charge and Transit Time.—A. Pérez. (*C. R. Acad. Sci., Paris*, 9th May 1949, Vol. 228, No. 19, pp. 1482–1484.) Starting from published tables (2977 of 1948), new tables have been derived covering the l.f. range. In the decimetre-wave region there should be an increase of the fluctuations with frequency, due to the Poisson emission of electrons. This may to a certain extent explain the high noise values observed.

621.385.2.032.216 **2674**

Testing Cathode Materials in Factory Production.—J. T. Acker. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, pp. 688–690.) Discussion of standard forms for reporting the results of tests of initial shrinkage, initial tube characteristics and life tests, in order to determine a figure of merit for the material. See also 2675 below.

621.385.2.032.216 **2675**

A Standard Diode for Electron-Tube Oxide-Coated Cathode-Core-Material Approval Tests.—R. L. McCormack. (*Proc. Inst. Radio Engrs, W. & E.*, June 1949, Vol. 37, No. 6, pp. 683–687.) Report of the work of a committee set up by the American Society for Testing Materials to prepare a specification for a standard diode test. Construction details of the standard diode are tabulated and illustrated; standard parts have been made available to interested companies. A cathode-temperature/emission characteristic for each test lot is taken at anode voltage 40 V, and compared with the same characteristic foi a standard material. A figure of merit is deduced Satisfactory correlation between tests by different companies was thus achieved; in one case surface contamination of a particular sample was established as a result of the tests. Additional tests are briefly discussed. See also 2674 above.

621.385.3 **2676**

The Dyotron Tube as a Very-High-Frequency Oscillator.—R. A. Dehn. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, p. 220.) Summary only. See also 2979 of 1948.

621.385.832 : [537.291+538.691 **2677**

Electron Beam Deflection. Part 2 — Applications of the Small-Angle Deflection Theory.—R. G. E. Hutter. (*J. appl. Phys.*, Sept. 1947, Vol. 18, No. 9, pp. 797–810.) The theory discussed in part 1 (609 of 1948) is applied to deflection fields produced by parallel plates, parallel wires, semi-infinite coplanar sheets, and bent plates. Results are shown graphically. An electrolyte-tank potential-plotting device used for experimental verification is described. The deflection depends on the initial conditions and its relationship with field strength is slightly nonlinear. The resulting distortions of the spot and the c.r. tube pattern are calculated for several deflection fields and beam shapes, and methods of reducing such distortion are considered.

621.385.832 : 621.397.6 **2678**

Mass-Production Techniques for Television Kinescopes.—D. Y. Smith. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, p. 186.) Summary only.

621.396.615.142 **2679**

Pulsed Reflex Oscillator.—(*Electronics*, April 1949, Vol. 22, No. 4, p. 130.) Brief description of a rugged, miniature, v.m., external-cavity oscillator valve, Type QK-205 (RMA Type 5721), which can generate frequencies from 2 000 to 12 000 Mc/s. Operating characteristics are tabulated.

621.396.645 : 537.311.33 : 621.315.59 **2680**

The Transistor — its Properties and Characteristics.—W. H. Brattain & J. Bardeen. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, p. 32.) Summary only. See also 264 of January.

MISCELLANEOUS

621.38/.39(43) **2681**

German Electronics in World War II.—A. H. Sullivan, Jr. (*Elect. Engng, N.Y.*, May 1949, Vol. 68, No. 5, pp. 403–409.) Much effort was devoted after 1943 to radar anti-jamming devices, but with little success. Radio, radar, infra-red, proximity fuses, valves, ceramics, components and navigational devices were also investigated. Apparatus of various kinds listed below is briefly discussed:—(*a*) radar; Freya, Würzburg and Jagdschloss types, (*b*) radio; Type FuG 16 v.h.f. aircraft equipment, which was extremely selective and stable; Type FuG 24, a mass-produced equipment weighing only 35 lb, with frequency range 37–50 Mc/s; the Peil G6 standard d.f. receiver, (*c*) V-1 and V-2 rockets, (*d*) Tonschreiber and magnetophon magnetic tape recorders, (*e*) metal-lens, iron-core and multi-element dielectric aerials, (*f*) a c.r. tube having two colours with different afterglow periods, (*g*) the Blauschrift, Mocos and Krawinkel storage tubes, (*h*) carbon-film resistors, (*i*) inductors formed by depositing metallized coatings on ceramics, (*j*) synthetic-mica and metallized-paper capacitors.

621.396 **2682**

The Radio Amateur's Handbook. [Book Review]—Headquarters Staff of the American Radio Relay League. American Radio Relay League, West Hartford, Conn., 26th edn 1949, 605 pp., 15s. 6d. (*Wireless World*, June 1949, Vol. 55, No. 6, p. 215.) Most of the chapters have been revised, particularly in the case of v.h.f., microwave and aerial equipment. 52 pages of valve data are included. Obtainable from A. F. Bird, 66 Chandos Place, London, W.C.2, at 16s. 3d., including postage, or through the Radio Society of Great Britain, New Ruskin House, Little Russell St., London, W.C.2, at 12s. 6d., including postage, for delivery from America.

ABSTRACTS and REFERENCES

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The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

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ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 **2683**

References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, March 1949, Vol. 21, No. 2, pp. 146–152.) Continuation of 2114 of August.

534.2 **2684**

On the Theory of Steep-Fronted Plane Pressure-Waves.—H. Pfriem. (*Akust. Z.*, July 1941, Vol. 6, No. 4, pp. 222–244.)

534.21 **2685**

Sound Radiation from a Finite Cylinder.—P. G. Bordoni & W. Gross. (*J. Math. Phys.*, Jan. 1949, Vol. 27, No. 4, pp. 241–252.) The radiated power and directional characteristics are calculated for a cylindrical source with one vibrating face. The approximate solution of the wave equation is determined by a minimum method. The results obtained are in good agreement with those derived for an equivalent spherical source.

534.21 **2686**

The Propagation of Sound in Composite Media.—R. J. Urick & W. S. Ament. (*J. acoust. Soc. Amer.*, March 1949, Vol. 21, No. 2, pp. 115–119.) Theory of a method for determining the propagation constant in media containing numerous small spherical particles.

534.213 : 629.13.038.1 **2687**

The Effect of its Aerodynamic Properties on the Sound Field and Radiation Power of a Propeller.—W. Ernsthausen. (*Akust. Z.*, July 1941, Vol. 6, No. 4, pp. 245–261.)

534.213.4-14 **2688**

Propagation of Sound Waves along Liquid Cylinders.—W. J. Jacobi. (*J. acoust. Soc. Amer.*, March 1949, Vol. 21, No. 2, pp. 120–127.) A theoretical and experimental treatment of guided transmission within circular cylinders of ideal liquid, with various non-dissipative boundary conditions.

534.232 **2689**

Investigations on the Production of Pressure Pulses by Cavitation.—H. G. Möller & A. Schoch. (*Akust. Z.*, May 1941, Vol. 6, No. 3, pp. 165–173.) A magnetostriction oscillator with a fundamental frequency of about 9 kc/s was used. Cavitation occurred in water when the current through the oscillator coil exceeded 0.3 A. The pressure effects were observed both by a schlieren method and by means of quartz or tourmaline microphones for a wide range of sound pressures, the maximum oscillator current being 0.8 A. Sound-pressure oscillograms are reproduced. The results obtained with the microphones can only be regarded as qualitative.

534.26 **2690**

On Diffraction through a Circular Aperture.—J. W. Miles. (*J. acoust. Soc. Amer.*, March 1949, Vol. 21, No. 2, pp. 140–141.) Analysis based on the variational method of Schwinger.

534.26 **2691**

A Note on the Kirchhoff Approximation in Diffraction Theory.—R. D. Spence. (*J. acoust. Soc. Amer.*, March 1949, Vol. 21, No. 2, pp. 98–100.) The diffraction patterns calculated by use of the Kirchhoff approximation are compared with the exact theory for the special case of a circular aperture. The approximation may be used to determine the average value of the normal velocity provided that the mean radius of the aperture is greater than or not much less than λ. In this case the diffraction patterns calculated from the Kirchhoff approximation are reasonably accurate for angles less than that of the first minimum.

534.26 : 534.321.9 **2692**

Criteria for Normal and Abnormal Ultrasonic Light Diffraction Effects.—G. W. Willard. (*J. acoust. Soc. Amer.*, March 1949, Vol. 21, No. 2, pp. 101–108.)

534.321.9 : 534.6 **2693**

Investigations of Acoustic Phenomena in Solids by means of F.M. Ultrasonic Vibrations.—F. Kruse. (*Akust. Z.*, May 1941, Vol. 6, No. 3, pp. 137–149.) The spectrum of a f.m. oscillation with a triangular modulation curve is considered. The application of such a 'wobbled' oscillation to eliminate or reduce natural oscillations in samples under test is discussed and illustrated by the results of numerous experiments. The complete elimination of stationary waves is not practicable.

534.321.9.001.8 **2694**

The Production of High Intensity Ultrasonics at Megacycle Frequencies.—G. G. Selman & M. H. F. Wilkins. (*J. sci. Instrum.*, July 1949, Vol. 26, No. 7, pp. 229–231.) Details of apparatus designed for the irradiation of biological material. A high-power Hartley oscillator was used in conjunction with a piezoelectric generator immersed in oil. Increased power was not developed by the use of transmission plates. Various focusing devices were investigated. Beams of unfocused ultrasonic radiation were generated and measured calorimetrically up to a maximum intensity of 55 W/cm². The dielectric strength of the transformer oil used limited the power output.

534.373 **2695**

Sound Attenuation in Absorption Tubes.—W. Willms. (*Akust. Z.*, May 1941, Vol. 6, No. 3, pp. 150–165.) The walls of an absorption tube are coated with porous material. The attenuation in such tubes is treated by means of the expression for the wall resistance. The method of treatment is only valid for low frequencies. In the case where the absorbent lining is of very great thickness, the attenuation in the region of lowest frequencies is proportional to $f^{3/2}$, but at higher frequencies it is proportional to $f^{1/2}$. With linings of small thickness the attenuation is proportional to f^2 and decreases rapidly toward the lower frequencies.

The problem is also treated by means of wave theory, which is applied to propagation in a channel between two layers of absorbing material. At low frequencies the same results are obtained as by the first method, but the attenuation, after passing through a maximum at very high frequencies, thereafter decreases again in proportion to $f^{-3/2}$. Experimental results confirm the theory.

534.373 : 534.321.9 **2696**

On the Ultrasonic Opacity of Porous Media.—G. A. Homès. (*C. R. Acad. Sci., Paris*, 30th May 1949, Vol. 228, No. 22, pp. 1695–1697.) Experiments at a frequency of 1 Mc/s indicate a definite correlation between the opacity of water containing air bubbles and the degree of aeration. Transmission through water containing many air bubbles was only 2% of that for water free from bubbles. Similar results were obtained with disks of paraffin wax filled with metal balls of various diameters. With 1-mm balls the transmission was 2% and with 5-mm balls 10% of that for pure paraffin wax.

534.373 : 534.6 **2697**

On the Pulse Method of Measuring Ultrasonic Absorption in Liquids.—J. M. M. Pinkerton. (*Proc. phys. Soc.*, May 1949, Vol. 62, No. 353B, pp. 286–299.) The choice of the optimum conditions for accuracy is discussed and illustrated by practical examples. Pulse equipment working on six frequencies between 7.5 and 67.5 Mc/s is described.

534.6 : 534.321.9 **2698**

Sound Analysis with an Ultrasonic Plate Spectroscope.—E. Mohr. (*Akust. Z.*, July 1941, Vol. 6, No. 4, pp. 209–222.) A spectroscope for sound analysis using a diffraction grating has been described by Meyer & Thienhaus (453 of 1935 and 630 of 1936). Instead of the grating the author here uses a plate analogous to the Fabry-Perot and Lummer-Gehrcke plates used in optics. The apparatus and its method of use are described. An ultrasonic oscillation of frequency 45 kc/s is modulated by the sound to be analysed and the upper sideband is resolved by the plate spectroscope. For the low audio frequencies a resolution of about 60 c/s is attained. Typical results are illustrated and phase errors are discussed.

534.62 **2699**

Principles of Design of [sound-]**Deadened Rooms.**—M. Milosevic. (*Rev. tech. Comp. franç. Thomson-Houston*, May 1949, No. 12, pp. 17–34.) Detailed discussion, with special reference to the absorbent properties of the walls, floor and roof, thickness of absorbing material, insulation against external noise and mechanical vibration. Examples of the acoustic characteristics obtained with various practical methods of construction are illustrated.

534.64 **2700**

Measurement of Acoustic Impedance.—O. K. Mawardi. (*J. acoust. Soc. Amer.*, March 1949, Vol. 21, No. 2, pp. 84–91.) The impedance of a sample of material forming one boundary of a shallow cylindrical cavity is measured by determining the sound pressure produced when a known volume current enters the cavity from a high-impedance source. The volume current is determined by observing the pressure when the cavity is rigidly terminated. The first radial mode of the cavity is suppressed by using a ring source; the frequency limit set by uniformity of pressure is thus extended by at least an octave. Secondary effects due to finite source and microphone impedance and to heat losses at the walls are evaluated. The method is simple, rapid, and precise.

534.64 **2701**

The Acoustic Reactance of Small Circular Orifices.—R. H. Bolt, S. Labate & U. Ingård. (*J. acoust. Soc. Amer.*, March 1949, Vol. 21, No. 2, pp. 94–97.) A precise experimental measurement of the reactance of orifices 0.35–2 cm in diameter and with diameter/length ratios from 4 to 40, for the frequency range 200–1 000 c/s. Comparison with calculated values shows agreement for the larger orifices only. The correction factor for small orifices of radius <1 cm is examined.

534.75 **2702**

Adaptation of the Ear to Sound Stimuli.—E. Lüscher & J. Zwislocki. (*J. acoust. Soc. Amer.*, March 1949, Vol. 21, No. 2, pp. 135–139.) Adaptation is defined as the elevation of the auditory threshold by a previous sound stimulus; for a stimulus 80 db above the auditory threshold the adaptation is 40–50 db. The entire process of adaptation and the return to normal sensitivity are each complete within a few tenths of a second. Methods and apparatus for measuring adaptation are described.

534.76 : 534.862 **2703**

The Fundamentals of Sound-Film Stereophonic Transmission for Halls.—H. Warncke. (*Akust. Z.*, May 1941, Vol. 6, No. 3, pp. 174–188.) A theoretical discussion. With a suitable arrangement of directional microphones for recording, a 2-channel system feeding two loudspeakers can give good performance.

534.851 : 621.395.813 **2704**

Analysis, by the Two-Frequency Intermodulation Method, of Tracing-Distortion Encountered in Phonograph Reproduction.—H. E. Roys. (*RCA Rev.*, June 1949, Vol. 10, No. 2, pp. 254–269.)

534.851 : 621.395.813 **2705**

Tracing-Distortion in Phonograph Records.—M. S. Corrington. (*RCA Rev.*, June 1949, Vol. 10, No. 2, pp. 241–253.) The results of Lewis & Hunt (730 of 1942) for the amount of distortion produced when a spherical stylus traces a groove in a gramophone record are extended by considering more terms of the series.

534.86 **2706**

To What Extent does Distortion really matter in the Transmission of Speech and Music?—(*Proc. Instn elect. Engrs*, Part III, May 1949, Vol. 96, No. 41, pp. 235–236.) Continuation of the discussion noted in 2149 of 1948.

621.392.51 **2707**

A Theory of the Crystal Transducer for Plane Waves.—W. G. Cady. (*J. acoust. Soc. Amer.*, March 1949, Vol. 21, No. 2, pp. 65–73.) The vibration amplitude, radiated power and electrical admittance are derived from the equations of propagation of acoustic waves through a solid medium. The transducer consists of a single element or a mosaic of crystals with a backing plate and a diaphragm. The general equations, which are valid for all conditions, are applied to the special case in which the backing is air. Particular attention is paid to the resonance conditions.

621.395.61/.62 : 537.228.1 **2708**

Rochelle-Salt Crystals in Telephony.—L. Sengewitz. (*Fernmeldetech, Z.*, July 1949, Vol. 2, No. 7, pp. 219–222.) The replacement of magnet systems by crystal units in telephone operators' gear has resulted in a reduction in the total weight of the equipment from 430 g to 62 g. A simple type of crystal amplifier, with a moderately uniform frequency-response curve from 50 c/s to 10 kc/s, is also described.

621.395.625.3 **2709**

The New Portable Tape Recorder.—W. E. Stewart. (*Broadcast News*, April 1949, No. 54, pp. 6–13.) Illustrated description and technical characteristics of the R.C.A. Type RT-3A recorder. The amplifier is fitted in a separate carrying case. Tape speed can be either 7.5 or 15 in/sec and automatic torque and tension controls are provided. The 'erase', 'record' and 'reproduce' heads are mounted in a single plug-in unit and tape threading is particularly simple. Response is essentially flat from 50 to 15 000 c/s.

621.395.625.3 : 534.852.6 **2710**

Noise in Magnetic Recording Systems as Influenced by the Characteristics of Bias and Erase Signals.—J. W. Gratian. (*J. acoust. Soc. Amer.*, March 1949, Vol. 21, No. 2, pp. 74–81.)

681.85 **2711**

A Record Changer and Record of Complementary Design.—B. R. Carson, A. D. Burt & H. I. Reiskind. (*RCA Rev.*, June 1949, Vol. 10, No. 2, pp. 173–190.) Equipment specially designed to minimize damage of records during handling or changing, to give a longer record life and improved quality of reproduction. The new type of record is much smaller than the usual 78-r.p.m. type and is operated at 45 r.p.m. With 275 grooves per inch the playing time is 5⅓ minutes.

621.392.51 **2712**

Electromechanical Transducers and Wave Filters. [Book Review]—W. P. Mason. Publishers: D. Van Nostrand Co., New York, 2nd edn 1948, 419 pp., $6.00. (*Rev. sci. Instrum.*, April 1949, Vol. 20, No. 4, pp. 314–315.) ". . . a scholarly and thorough book on the theory of electrical networks and vibration of coupled acoustical, mechanical and electrical systems employing electrical, mechanical and acoustical analogies."

AERIALS AND TRANSMISSION LINES

621.392.26(083.74)† **2713**

Standard for Waveguides.—Fenn. (*See* 2861.)

621.396.67 **2714**

Aerials with Feedback.—J. Grosskopf. (*Frequenz*, June 1949, Vol. 3, No. 6, pp. 157–164.) In the case of rhombic transmitting aerials the energy arriving at the end remote from the feed point is usually absorbed in a resistance, but with a suitable transformer and double conductor the energy may be led back to the feed point. Theory of such an arrangement is given and practical methods are described, with a few experimental results on model equipment.

621.396.67 **2715**

On the Infinitely Long Cylindrical Antenna.—C. H. Papas. (*J. appl. Phys.*, May 1949, Vol. 20, No. 5, pp. 437–440.) The method of steepest descents is used to obtain the asymptotic form of the current distribution for a perfectly conducting aerial excited by a localized e.m.f. The l.f. value of the radiation conductance is determined by integrating the radiated energy flux over a large sphere. See also 1589 of June (Hallén).

621.396.67 : 621.317.74.029.64 **2716**

A New Type of Slotted-Line Section.—W. B. Wholey & W. N. Eldred. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, p. 221.) Summary only. Conventional slotted lines require very accurate machining tolerances and care in construction if accurate measurements of voltage s.w.r. are to be obtained. By use of the transformation $\omega = \tan z$ the concentric line may be converted to two parallel semi-infinite planes with a slightly elliptical centre conductor midway between. Simple modifications of this configuration will permit the construction of a slotted line section that is far less critical with respect to mechanical dimensions than its coaxial equivalent and will exhibit considerably less external energy radiation. Lines embodying this principle have been constructed and were found to have excellent electrical properties when only moderate mechanical accuracies were used in their construction. In a line covering the frequency range 500 to 4 000 Mc/s a s.w.r. of only 1.006 was obtained for the basic slotted section and the necessary transition section to coaxial line.

This paper covers the theory of the 'slab line' and the method of construction. Two types of line are described covering the frequency range 500 to 4 000 Mc/s and 3 000 to 10 000 Mc/s; performance and the experimental measuring procedure are briefly discussed.

621.396.67 : 621.396.931 **2717**

Mobile Radio Antennas for Railroads.—W. C. Babcock. (*Bell. Lab. Rec.*, May 1949, Vol. 27, No. 5, pp. 172–175.) Discussion of rugged $\lambda/4$ aerials folded and bent so as to make full use of limited overhead clearance.

621.396.67 : 621.397.6 **2718**

Receiving Aerials for Television.—H. C. Roosenstein. (*Radio franç.*, June 1949, No. 6, pp. 11–20.) Measurements on vertical receiving aerials were carried out at the end of a pier projecting into a lake, the transmitter being on a second pier 100 m away. The results indicate that such aerials, when provided with parasite stoppers, give good performance. Two types of aerial are described.

621.396.67 : 621.397.7 **2719**

Indoor Television Aerial.—N. M. Best & P. J. Duffell. (*Wireless World*, July 1949, Vol. 55, No. 7, pp. 255–258.) Discussion of the requirements of a compressed dipole for strong-signal areas, and the mechanical construction of a suitable dipole with loading coil and stub line.

621.396.677 : 621.397.6 **2720**

Reversible-Beam Antenna for Twelve-Channel Television Reception.—O. M. Woodward, Jr. (*RCA Rev.*, June 1949, Vol. 10, No. 2, pp. 224–240.) A combination of end-fire and broadside pairs of horizontal dipoles resonant at 65 Mc/s gives a unidirectional radiation pattern over the 54–88-Mc/s band. By loading the dipoles with V reactances, satisfactory patterns are also obtained over the 174–216-Mc/s band. By means of a 'diplexer' bridge feed and balanced-line feeders, independent operation of the two arrays is ensured, ghost images are eliminated, and switched beam reversal is obtained. Field patterns and standing-wave characteristics of the system are given.

621.396.67 **2721**

Microwave Antenna Theory and Design. [Book Review]—S. Silver. McGraw-Hill, London, 623 pp., 48s. (*Wireless Engr*, June 1949, Vol. 26, No. 309, pp. 199–200.) Vol. 12 of the M.I.T. Radiation Laboratory series. "... undoubtedly a very valuable addition to the literature of the subject. Although written by several authors it shows no sign of discontinuity ... no trouble has been spared to make the book as authoritative and at the same time as readable as possible."

621.396.677.029.6 **2722**

Breitband-Richtstrahlantennen mit Anpassvierpolen für Ultrakurzwellen. (Wide-Band Directive Aerials with Matching Quadripoles for Ultrashort Waves.) [Book Review]—R. Peter. Publisher: Leemann, Zürich, 88 pp., 8 fr. (Swiss). (*Wireless Engr*, July 1949, Vol. 26, No. 310, p. 245.) The first section deals with non-directive cylindrical and conical aerials, their impedance and equivalent circuits. Reflectors are considered next. The greater part of the book is concerned with filters and 4-pole matching devices, especially the use of ladder filters to obtain a wide passband.

CIRCUITS AND CIRCUIT ELEMENTS

621.3.012.2 **2723**

Standing Waves and Impedance Circle Diagrams.—C. H. Westcott. (*Wireless Engr*, July 1949, Vol. 26, No. 310, pp. 230–234.) A graphical method of determining the form and phase of standing waves, and an explanation of impedance circle diagrams for transmission lines with and without attenuation.

621.3.015.3 : 778.3 **2724**

A New Method for the Photographic Study of Fast Transient Phenomena.—J. S. Courtney-Pratt. (*Research, Lond.*, June 1949, Vol. 2, No. 6, pp. 287–294.) For transients lasting 10^{-7}–10^{-8} sec. An image-converter tube is used in equipment giving results similar to those obtained with drum cameras.

621.314.2 **2725**

Design Charts for Air-Cored Transformers.—C. N. Jeffery. (*A.W.A. tech. Rev.*, April 1949, Vol. 8, No. 2, pp. 167–183.) The charts are based on values of Nagaoka's constant. Their derivation is explained and examples of their application are given. They are suitable for various types of coaxial windings of common diameter and pitch. The choice of winding form is also considered.

621.314.2 **2726**

A Design for Double-Tuned Transformers.—J. B. Rudd. (*A.W.A. tech. Rev.*, April 1949, Vol. 8, No. 2, pp. 147–165.) Description of a method of designing transformers (including networks consisting of a pair of LC circuits with inductive or capacitive coupling) to provide uniform transmission of power over a range of frequencies. The resulting insertion-loss curve is approximately symmetrical when plotted on a linear frequency scale. The frequency variable used in the design equations allows a common representation of both inductively and capacitively coupled forms. The extent of the uniform transmission band and the transformation ratios possible with various types of coupling are discussed. Charts which simplify the process of design are included.

621.314.26 : 621.397.6.029.63 **2727**

Continuously Tuned Converter for U.H.F. Television.—R. P. Wakeman. (*Electronics*, July 1949, Vol. 22, No. 7, pp. 68–71.) The converter is designed to cover the band 475–890 Mc/s, to enable existing television receivers in the U.S.A. to cover the proposed u.h.f. channels. It is a modification of the Karplus coaxial tuner (3260 of 1945).

621.314.3† **2728**

Magnetic Amplifiers.—A. G. Milnes. (*Proc. Instn elect. Engrs*, Part I, May 1949, Vol. 96, No. 99, pp. 89–98. Discussion, pp. 115–124.) An explanation of transductor action is given, and the effect of permeability on performance is described for the case of self-excitation. Arrangements of transductors to give duo-directional magnetic amplifiers are considered. Fundamental design principles are developed in which power output, amplification and time lag are related to supply frequency, core area and self-excitation or feedback.

To obtain a high amplification/time-constant ratio, a high supply frequency should be used and several stages with positive feedback should be connected in cascade. Transductors are a valuable addition to circuit technique for the amplification of d.c. powers down to about 10^{-9} W. Reprinted *ibid.*, Part II, June 1949. Vol. 96, No. 51, pp. 329–338. Discussion, pp. 355–364.

621.314.3† **2729**

A Theoretical and Experimental Study of the Series-Connected Magnetic Amplifier.—H. M. Gale & P. D. Atkinson. (*Proc. Instn elect. Engrs*, Part I, May 1949, Vol. 96, No. 99, pp. 99–114. Discussion, pp. 115–124.) The mathematical analysis of magnetic amplifiers is made difficult by the nonlinear characteristic of the iron. Neglecting leakage reactance and assuming an ideal B/H characteristic, a solution can be obtained which shows that the steady-state and transient operation of an amplifier with one of the two basic circuits here analysed depend on only three dimensionless coefficients. This solution leads to simple semigraphical methods of determining the steady-state current and flux waveforms, and the response to sudden changes in input. Satisfactory agreement between theoretical and experimental results has been obtained. Improvements in core characteristics have led to a simplified method of designing amplifier windings, and amplifier delays have been reduced in a ratio of about 10 : 1 by the use of special circuits. Reprinted *ibid.*, Part II, June 1949, Vol. 96, No. 51, pp. 339–354. Discussion, pp. 355–364.

621.314.3† **2730**

Barkhausen Noise and Magnetic Amplifiers: Part 1 — Theory of Magnetic Amplifiers.—J. A. Krumhansl & R. T. Beyer. (*J. appl. Phys.*, May 1949, Vol. 20, No. 5, pp. 432–436.) Open-circuit output voltages are calculated for nonlinear transformers driven by a sinusoidal primary current with or without a d.c. bias. The case of a loaded secondary is also considered; conditions for instability and for resonance are derived. See also 664 of 1948 (Sack et al.).

621.314.3† **2731**

Feed-Back in Magnetic Amplifiers : Parts 1 & 2.—A. S. Fitzgerald. (*J. Franklin Inst.*, March & May 1949, Vol. 247, Nos. 3 & 5, pp. 223–243 & 457–471.)

621.314.63+621.315.59 **2732**

Semi-Conductors and Rectifiers.—Mott. (*See* 2814.)

621.316.722.4 **2733**

The Problem of Voltage Division for Centimetre and Millimetre Waves.—O. Macek. (*Frequenz*, April 1949, Vol. 3, No. 4, pp. 117–121.) In waveguides of diameter d less than the critical diameter d_c for a particular wavelength, propagation cannot take place and the electric and magnetic fields decrease exponentially with distance along the waveguide. The decrease is the more rapid the smaller the ratio of d to d_c. Attenuation arrangements based on the above principle are described and formulae are given which are applicable to H and E waves. Practical applications in measurement technique are discussed.

621.316.729 : 621.396.615 **2734**

The Synchronization of Relaxation Oscillations at the Fundamental and Subharmonic Frequencies of the Applied Electromotive Force.—V. V. Vitkevich. (*Radiotekhnika, Moscow*, May/June 1949, Vol. 4, No. 3, pp. 76–77. In Russian.) The effects of various factors on the synchronization bandwidth are discussed.

621.316.8 **2735**

Fixed Resistors for use in Communication Equipment.—P. R. Coursey. (*Proc. Instn elect. Engrs*, Part III, May 1949, Vol. 96, No. 41, pp. 169–180. Bibliography, pp. 180–182. Discussion, pp. 182–186.) An account of the historical development and a review of the construction and properties of eight different types. The manufacture and the main electrical and h.f. properties of the latest forms of pyrolitic-carbon high-stability resistors are discussed.

621.318.4 **2736**

On the Design of H.F. Coils with Powdered-Iron Cores.—H. Nitsche. (*Funk u. Ton*, June 1949, Vol. 3, No. 6, pp. 320–327.) For determining the inductance, the most important quantity is what is termed the inductance factor $A_L = \mu H/N^2$, where N is the number of turns and μ the core permeability. Curves are given showing how A_L depends on the distribution of the winding in the slots of a 3-slot coil former and on the degree of filling-up of the slots, both for cylindrical and pot cores.

621.318.4 : 621.397.6 **2737**

Television I.F. Coil Design.—J. H. Felker. (*Electronics*, March 1949, Vol. 22, No. 3, p. 122.) A chart giving in one operation the number of close-wound turns of wire of given diameter required for a coil of given radius and inductance. Reprinted in *Bell Lab. Rec.*, May 1949, Vol. 27, No. 5, p. 181.

621.318.42 : 621.394/.395] .813 **2738**

The Frequency Dependence of the Voltage Distortion for Coils with Ordinary Commercial Laminated-Iron Cores.—H. Kämmerer. (*Fernmeldetch. Z.*, July 1949, Vol. 2, No. 7, pp. 201–206.) Hysteresis and eddy-current theory indicates that the distortion in such coils should decrease with increasing frequency. Measurements on coils with cores of various commercially available materials, including mumetal, permenorm 3601 K1, trafoperm 25 N1 and dynamo-sheet IV, confirm the theoretical conclusions. For some materials the measured change of distortion with frequency for very weak a.c. fields is in good agreement with the calculated variation. The discrepancies with other materials are attributed to magnetic inhomogeneity.

621.318.572 **2739**

Reactive Trigger Circuits.—S. A. Drobov. (*Radiotekhnika, Moscow*, May/June 1949, Vol. 4, No. 3, pp. 21–35. In Russian.) An analysis of such circuits which gives a clear picture of the processes taking place. An equivalent circuit and its simplified triggering characteristics are discussed. The effects of various operating conditions on the triggering voltage, and applications to the lengthening and shortening of pulses, to frequency division and to multivibrators are also considered.

621.318.572 : 539.16.08 **2740**

Electronic Counters for Pulses.—P. Naslin & A. Peuteman. (*Onde élect.*, June 1949, Vol. 29, No. 267, pp. 241–254.) Essentially the same as 660 of March.

621.392 **2741**

Thévenin's Theorem.—"Cathode Ray". (*Wireless World*, July 1949, Vol. 55, No. 7, p. 275.) Helmholtz stated and used this theorem 30 years before Thévenin independently enunciated it very clearly and made it generally known. See also 1615 of June.

621.392.4 **2742**

Low-Frequency Discriminator.—H. M. Crain. (*Electronics*, June 1949, Vol. 22, No. 6, pp. 96–97.) A phase inverter which has equal anode and cathode loads is used to drive a RC phase shifter. The output voltages behave like the voltages from conventional discriminators.

621.392.41 : 621.317.729 **2743**

An Electrolytic Tank for the Measurement of Steady-State Response, Transient Response, and Allied Properties of Networks.—A. R. Boothroyd, E. C. Cherry & R. Makar. (*Proc. Instn elect. Engrs*, Part I, May 1949, Vol. 96, No. 99, pp. 163–177.) A computer based on an analogy due to P. J. Daniell (Ministry of Supply Servo Library, Ref. B.39), relating the impedance function of a linear network of lumped elements to the potential distribution and current flow set up in a uniform sheet of conducting material by point electrodes. An overall accuracy within 1% has been obtained by the elimination of tank boundary errors and of electrode polarization troubles.

621.392.5 **2744**

Matrix Analysis of Linear Networks including Active Quadripoles.—A. Pinciroli & A. Taraboletti. (*Alta Frequenza*, April 1949, Vol. 18, No. 2, pp. 73–82. In Italian, with English, French and German summaries.) Active and passive networks are considered as systems of 4-terminal components and this concept is applied to the study of networks which include valves. General results are thus simply derived.

621.392.5 **2745**

The Synthesis of Passive, Resistanceless Four-Poles that may violate the Reciprocity Relation.—B. D. H. Tellegen. (*Philips Res. Rep.*, Oct. 1948, Vol. 3, No. 5, pp. 321–337.) An investigation of the most general quadripoles of this type. They can be realized by means of inductors, capacitors, ideal transformers and ideal gyrators. The 'order' of a quadripole is the order of the differential equation of its free oscillations. There are two types of quadripole for each order, either of which can be transformed into the other by connecting an ideal gyrator to any of their terminal pairs. Necessary and sufficient conditions for realization are derived. See also 980 of April.

621.392.5 **2746**

The Double-T Resistance-Capacitance Network.—L. Gerardin. (*Rev. tech. Comp. franç. Thomson-Houston*, May 1949, No. 12, pp. 5–15. In French, with English summary.) Analysis is based on the matrix theory of passive quadripoles. Transmission characteristics are fully discussed, numerous curves being given for particular cases, and general relations between the values of the circuit components are derived for the frequency at which the transmission is zero. The principal application of the double-T network, besides measurement or filter circuits, is in amplifier feedback circuits, where its use enables l.f. amplifiers of high quality to be produced cheaply, as well as oscillators with little distortion. Examples of such applications are discussed.

621.392.5 : 534.321.9 **2747**

Improved Ultrasonic Delay Lines.—F. A. Metz, Jr, & W. M. A. Andersen. (*Electronics*, July 1949, Vol. 22, No. 7, pp. 96–100.) Experiments were carried out to find a solid medium from which lines having delays of 3 ms or more could be constructed for a carrier frequency of at least 10 Mc/s and a bandwidth >2 Mc/s. Fused quartz and forged Mg alloys were found to give the least attenuation. The bandwidth of a solid delay line using cemented crystals was found to be too narrow for the storage of narrow pulses. Bonding between the crystal and the delay line was improved by pressure mounting, which gave an increased bandwidth. Tables of results, circuit diagrams, and oscillograms are given. See also 1578 of 1948 (Arenberg).

621.392.52 **2748**

General Forms of Ladder-Filter Half-Sections classed according to the Value of the Image-Impedance Transfer Index.—J. E. Colin. (*Câbles & Transmission, Paris*, July 1949, Vol. 3, No. 3, pp. 229–247.) All inductances and capacitances are considered as positive, without loss and without mutual inductance. Definitions are given and fundamental ideas are reviewed. Discussion of the general laws for ladder filters is limited to those with direct application to sections with one or with two cut-off frequencies. Ladder filters of this type are classified and discussed and their characteristics are tabulated.

621.392.52 **2749**

Simplification of Bandpass Filter Calculations using Curves applicable to any Bandwidth.—J. C. Stewart & K. M. Garven. (*Commun. Rev.*, Sept. 1948, Vol. 1, No. 4, pp. 18–23.) Curves are plotted giving the attenuation as a function of the parameter y defined by

$$(f_2 - f_1)y = f - (f_1 f_2 / f)$$

where the pass band is between frequencies f_1 and f_2, and f is the operating frequency. Such curves can be applied to filters of any bandwidth and frequency. The calculation of the curves and procedure for using them are discussed; further details are given in Data Sheets Nos. 3–5 supplied with the journal.

621.392.52 : 621.317.729 **2750**

Empirical Determination of Wave-Filter Transfer Functions with Specified Properties.—J. F. Klinkhamer. (*Philips Res. Rep.*, Feb. & Oct. 1948, Vol. 3, Nos. 1 & 5, pp. 60–80 & 378–400.) The position of the transmission bands in the frequency spectrum, the permissible variation of the attenuation within these bands, and the position and minimum attenuation of the attenuation bands are supposed to be given. A method of determining the transfer function is described which is based on measurements in an electrolyte tank. The method is applicable to filters with several transmission and attenuation bands and is more general than that of Cauer (392 of 1942) though closely related to it. When the filter has one transmission band and one attenuation band, or several transmission bands and attenuation bands with equal attenuation properties, the results of the two methods are identical. The procedure adopted in the actual determination of a transfer function is fully described.

621.392.52 : 621.394.813 **2751**

Effect of Filtering on Telegraphy Distortion.—H. Gardère. (*Câbles & Transmission, Paris*, July 1949, Vol. 3, No. 3, pp. 248–261.) If the total distortion of a communication link due to considerable variations of signal level and supply voltage is to be reduced to less than 5%, that due solely to filtering must be small, probably not exceeding about 1%. The results of a study of the distortion of an elementary signal are applied to a theoretical low-pass filter and to a section of an actual low-pass filter. From this it appears that the required low distortion can only be attained with a bandwidth 1.5 times the telegraphy frequency.

621.392.52 : 621.395.44 **2752**

Band-Pass Filter, Band-Elimination Filter and Phase-Simulating Network for Carrier Program Systems.—F. S. Farkas, F. J. Hallenbeck & F. E. Stehlik. (*Bell Syst. tech. J.*, April 1949, Vol. 28, No. 2, pp. 196–220.) Design details and performance of three units for the carrier system noted in 2905 below.

621.395.665.1 **2753**

Contrast Expansion.—L. J. Wheeler. (*Wireless World*, July 1949, Vol. 55, No. 7, p. 277.) Correction to 2171 of August.

621.396.611.011.4 : 621.316.761.2 **2754**

Temperature Compensation of Oscillatory Circuits.—E. Roske. (*Funk u. Ton*, June 1949, Vol. 3, No. 6, pp. 328–340.) The temperature coefficients of capacitors made from the various ceramic products of the Hescho, Hermsdorf A.G. range from positive values of $90–180 \times 10^{-6}$ per 1°C for calit to negative values of $680–860 \times 10^{-6}$ per 1°C for condensa. With proper selection and adjustment of trimmer capacitors it is thus possible to compensate for the positive temperature coefficients associated with normal inductors and capacitors and obtain a circuit whose temperature coefficient of frequency is nearly zero. Several numerical examples are given, including a series-parallel arrangement which reduces the capacitance temperature coefficient of a variable air-dielectric capacitor to a small negative value which is practically constant over the whole range.

621.396.611.1 **2755**

Q: How Many Kinds are there?—"Cathode Ray". (*Wireless World*, July 1949, Vol. 55, No. 7, pp. 267–271.) Consideration of the various interpretations of the symbol, as applied to coils and capacitors, and of their interconnection.

621.396.611.21 : 621.395.44 **2756**

A Crystal Oscillator for Carrier Supply.—H. N. Hansen. (*Commun. News*, Jan. 1949, Vol. 10, No. 1, pp. 1–15.) All carrier frequencies of the system discussed in 2356 of 1948 (Bast, Goedhart & Schouten) are derived from a single frequency of 60 kc/s, generated by a crystal-controlled master oscillator of the Colpitts type, in which the coil is replaced by the quartz crystal in series with a small capacitor serving for exact frequency adjustment. Frequency stability requirements and causes of drift are discussed, and the stability obtainable with a given crystal and a given valve are calculated, Results can be expressed in terms of straightforward equations, which are applied to a particular case. A practical circuit is given. The frequency stability of the well-known bridge-stabilized crystal oscillator is analysed similarly.

621.396.615 : 621.396.611.32 **2757**

Phase-Shift Oscillators with Very Tight Coupling.—M. Soldi. (*Alta Frequenza*, April 1949, Vol. 18, No. 2, pp. 52–68. In Italian, with English, French and German summaries.) The operating conditions are examined for single-valve oscillators with coupling much tighter than that necessary for self-oscillation. The RC phase-shifting network may be either of the high-pass or low-pass type. The latter is particularly considered; the waveform in this case resembles that of a multivibrator.

621.396.615.17 : 621.317.755 **2758**

Shock-Impulsed Spiral Time Base.—G. H. Rawcliffe. (*Wireless Engr*, July 1949, Vol. 26, No. 310, pp. 242–244.) An impulse is applied to an LCR circuit and the resulting damped oscillation is split by a CR circuit into two components in quadrature which are applied to the X and Y plates of a c.r. tube. An appendix discusses the geometry of the spiral and its relation to the *Q* of the oscillatory circuit. A similar circuit was described by Blok (4540 of 1938).

621.396.615.17 : 621.385.38 **2759**

A Thyratron Square-Wave Generator.—L. Reiffel. (*Rev. sci. Instrum.*, March 1949, Vol. 20, No. 3, pp. 218–219.) With argon-filled tubes the deionization time limits the frequency at which good square-waves can be produced to about 12 kc/s, but this may possibly be extended to 40 kc/s with hydrogen filling. Square waves of amplitude 1 kV can be obtained.

621.396.622.63 **2760**

Crystal Detectors.—O. Döhler. (*Elektrotechnik, Berlin*, June 1949, Vol. 3, No. 6, pp. 167–175.) The physical properties of crystal detectors are reviewed, production methods in Germany and abroad are described and applications in radio technique are discussed.

621.396.622.63 **2761**

Crystal Rectifiers.—(*Radio tech. Dig., Édn franç.*, Feb. 1949, Vol. 3, No. 1, pp. 7–19.) French version of 25 of January (Evans).

621.396.645 **2762**

Certain Additional Parameters of Valve [amplifier] **Circuits.**—M. M. Ayzanov. (*Radiotekhnika, Moscow*, May/June 1949, Vol. 4, No. 3, pp. 73–75. In Russian.) A general method is proposed for studying multi-stage amplifiers including feedback circuits. The amplifier is replaced by an equivalent quadripole system (Fig. 1) and various parameters of this system are derived.

621.396.645 **2763**

Earthed-Grid Power Amplifiers: Parts 1 & 2.—P. A. T. Bevan. (*Wireless Engr*, June & July 1949, Vol. 26, Nos. 309 & 310, pp. 182–192 & 235–242.) The maximum power output and sideband response are compared for earthed-grid and earthed-cathode r.f. amplifiers used in television transmitters. The necessary driving-power and modulation requirements are considered and a practical circuit is given for a grid-modulated earthed-grid amplifier, driven by a cathode follower, with an output of 50 kW and a bandwidth of 6 Mc/s. Complete neutralization and adjustment procedure for such an amplifier is described and power-gain control for two methods of neutralization is discussed. Filament heating is considered and the electrical and mechanical arrangements are illustrated for 10-kW and 25-kW f.m. earthed-grid coaxial-line amplifiers for the range 88–108 Mc/s, and also for a 50-kW earthed-grid parallel-line push-pull amplifier.

621.396.645 **2764**

Amplification by Direct Electronic Interaction in Valves without Circuits.—Guénard, Berterottière & Doehler. (*See* 2977.)

621.396.645.029.3 **2765**

Tunable A.F. Amplifier.—O. G. Villard, Jr. (*Electronics*, July 1949, Vol. 22, No. 7, pp. 77–79.) A variable-frequency circuit which can be used both as an a.f. oscillator from 200 to 10 000 c/s and as a selective amplifier for rejecting or emphasizing a particular frequency in this range.

621.396.645.029.42 : 621.362 **2766**

A Tuned Low-Frequency Amplifier for use with Thermocouples.—D. A. H. Brown. (*J. sci. Instrum.*, June 1949, Vol. 26, No. 6, pp. 194–197.) The radiation incident on the thermocouple is chopped at 5 c/s by means of a sectored disk and the thermocouple output is applied to an amplifier tuned to this frequency. The amplifier has a bandwidth of only 0.63 c/s and a specially designed input stage, with a resulting low noise level. The design of an associated input transformer and a mechanical rectifier for the amplified signals is also described.

621.396.645.371 **2767**

When Negative Feedback isn't Negative.—"Cathode Ray". (*Wireless World*, July 1949, Vol. 55, No. 7, p. 277.) Corrections to 2197 of August.

621.396.645.371 **2768**

Negative-Feedback Amplifiers.—C. F. Brockelsby. (*Wireless Engr*, July 1949, Vol. 26, No. 310, p. 247.) Author's reply to comment by McLeod (2196 of August) on 1910 of July.

621.396.662 **2769**

Calculation of Stagger-Tuned Circuits.—F. Juster. (*Toute la Radio*, July/Aug. 1949, Vol. 16, No. 137, pp. 207–210.) Complete design formulae for 2, 3 or 4 circuits in cascade are tabulated and their use is illustrated by a numerical example.

621.396.69 **2770**

New Radio Components in the World Market.—M. Alixant. (*Radio tech. Dig., Édn franç.*, Feb. 1949, Vol. 3, No. 1, pp. 21–47.) A detailed review of American and European valves, rectifiers, capacitors, transformers, coils, c.r. tubes, voltage-stabilizing tubes, microphones and loudspeakers now available.

621.397.645.371 **2771**

Cathode-Compensated Video Amplification : Parts 1 & 2.—A. B. Bereskin. (*Electronics*, June & July 1949, Vol. 22, Nos. 6 & 7, pp. 98–103 & 104–107.) A feedback method, resulting in simpler design, reduced cost, improved linearity, and nearly constant amplitude and time delay over the useful frequency range of operation. Compensating procedure is described in detail. A general formula for the gain is obtained and special cases are discussed. The input admittance is derived theoretically and values obtained are compared with experimental results. The performance characteristics of this and other types of amplifier are compared. For earlier work see 847 of 1945.

621.3.015.3 **2772**

Pulses and Transients in Communication Circuits. [Book Review]—C. Cherry. Chapman & Hall, London, 317 pp., 32s. (*Wireless Engr*, June 1949, Vol. 26, No. 309, p. 199.) The book is intended to 'bridge the gap between simple alternating-current theory and operational methods'. It is mainly concerned with the problem of estimating transient response, given the amplitude and phase characteristics. Approximate methods of general application are discussed, rather than precise calculations for given network configurations.

621.319.55 **2773**

Elektrische Kippschwingungen. [Book Review]—H. Richter. Publisher: S. Hirzel, Leipzig, 1940, 154 pp., 11.50 RM. (*Akust. Z.*, July 1941, Vol. 6, No. 4, p. 261.) Mathematical theory and practical circuits.

GENERAL PHYSICS

53 **2774**

Integral and Series Representations, in Rotation-Paraboloid Coordinates, for the Different Types of Wave of Mathematical Physics.—H. Buchholz. (*Z. Phys.*, 1948, Vol. 124, Nos. 3/6, pp. 196–218.)

53.081 + 621.3.081 **2775**

On the Rationalization of Units and of the Formulae of Electricity and Magnetism. For and Against.—L. Bouthillon. (*Bull. Soc. franç. Élect.*, July 1949, Vol. 9, No. 94, pp. 351–368.) Historical review, with comparison of the systems proposed by Giorgi, Darrieus and Sommerfeld. A note is added by É. Brylinski.

531.26 **2776**

Calculation of the Potential from the Asymptotic Phase: Part 2.—C. E. Fröberg. (*Ark. Mat. Astr. Fys.*, 4th May 1949, Vol. 36, Part 3, Section A, No. 11, 55 pp. In English.) In part 1 (3213 of 1948, whose U.D.C. should be as above) a rather complicated formula corresponding to Born's approximation was derived for determining the interaction between two particles from the phase shift under conditions of elastic scattering. A simplified formula is here given which can be generalized. A second approximation is also derived and methods of obtaining higher approximations are indicated. Necessary convergence conditions are deduced. The well potential, the Gauss potential and the Yukawa potential are considered specially.

534.21 : 548 **2777**

Axial Length-Oscillations of a Straight Rod of Crystalline Material.—R. Bechmann & V. Petržilka. (*Z. Phys.*, 1944, Vol. 122, pp. 589–599.) Theory of the elastic coupling between the longitudinal and transverse degrees of freedom explains the inclination observed between the direction of motion and the direction of wave propagation in the material. The direction of motion is determined by the polar surface of the fourth order and the nodal planes are tangential to this surface. Investigations with a number of X-cut rods, the angle between the rod axis and the crystallographic z-axis ranging from 20° to 160°, confirm the theory.

534.21 : 548 : 549.514.51 **2778**

Elastic Natural Oscillations of a Rectangular Quartz Parallelepiped.—R. Bechmann. (*Z. Phys.*, 1944, Vol. 122, pp. 510–526.) Continuation of 860 of 1945. Experimental results for crystals of various dimension ratios are compared with the values to be expected theoretically. Agreement is in general satisfactory for longitudinal vibrations, though discrepancies occur both in this case and also in the special case of crystals of cubical shape. To get agreement for transverse oscillations it is necessary to introduce a correction factor. See also 2187 of 1943.

535.42 : 535.13 **2779**

Diffraction of Plane Light Waves by Black Screens.—É. Durand. (*Rev. d'Optique*, June, 1949, Vol. 28, No. 6, pp. 325–351.) A formula obtained by the superposition of plane monochromatic waves, which is rigorously equivalent to Kirchhoff's formula, facilitates the passage from diffraction phenomena at a finite distance, of the Fresnel class, to phenomena at infinity, of the Fraunhofer type. The light vibrations are considered as scalar quantities; the modifications introduced by e.m. theory are only studied for systems of cylindrical symmetry. Semi-infinite screens, systems of parallel slits, and rectangular and circular holes are considered and also the bearing of the results on general e.m. theory and Huyghens' principle.

537.122 : 538.3 **2780**

On the Paraxial Electron-Optic Image.—F. Borgnis. (*Helv. phys. Acta*, 30th June 1949, Vol. 22, No. 3, pp. 261–264. In German.) Continuation of 1351 of May. The formation of real and of virtual images is considered.

537.525.8 **2781**

Some Aspects of the Glow Discharge between Coaxial Cylinders in the Presence of a Non-Homogeneous Axial Magnetic Field.—J. M. Somerville, K. S. W. Champion & E. K. Bigg. (*Aust. J. sci. Res., Ser. A*, Dec. 1948, Vol. 1, No. 4, pp. 400–411.)

538.114 **2782**

Some Present Views on the Theory of Ferromagnetism.—L. Néel. (*Bull Soc. franç. Élect.*, July 1949, Vol. 9, No. 94, pp. 308–315. Discussion, pp. 315–318.)

538.3 : 537.11 **2873**

The Law of Action between Moving Electric Charges, Theory and Applications.—F. Guéry. (*Bull. Soc. franç. Élect.*, June 1949, Vol. 9, No. 93, pp. 262–272.) A consistent theory of such action is here developed from first principles. Although Maxwell's theory is universally accepted, and Lorentz' theory is merely Maxwell's theory applied to the electron, Lorentz' theory appears to violate Newton's third law of motion; this is because the part played by the electrons producing the e.m. field is neglected. Applications to problems of terrestrial electricity and magnetism are discussed.

538.311 **2784**

Production of a Uniform High-Frequency Field.—E. Roeschen. (*Funk u. Ton*, June 1949, Vol. 3, No. 6, pp. 341–346.) The field due to the current in a circular coil is first calculated in terms of Legendre functions and the formulae are then applied to discussion of the field due to the currents in a symmetrical arrangement of two circular coils. The field between two such pairs of coils suitably dimensioned and spaced is essentially uniform for a considerable distance from the midpoint of the system.

538.566 : 537.562 **2785**

Plane Waves in an Ionized Gas with Static Electric and Magnetic Fields Present.—V. A. Bailey. (*Aust. J. sci. Res., Ser. A*, Dec. 1948, Vol. 1, No. 4, pp. 351–359.) General equations are derived which specify such waves to a first approximation when their amplitudes are small. The determinantal equation of dispersion is deduced and the nature of its roots is discussed. Under suitable conditions, some of the roots are associated with wave-groups which grow as they progress, and others with waves which grow with time. Previous results for e.m. propagation, plasma oscillations etc. are included as special cases. Applications to electrical oscillations, noise in discharge tubes, and cosmic noise are indicated.

539.23 : 537.311.31 **2786**

Reversible Effects of the Adsorption of Gases on the Electrical Conductivity of Very Thin Metallic Layers.—N. Mostovetch. (*C. R. Acad. Sci., Paris*, 30th May 1949, Vol. 228, No. 22, pp. 1702–1704.) Experiments with layers of Mo, Pt, Rh, Ni, Au in low-pressure atmospheres of air, N, H, O, CO_2 show that the resistance of layers with negative temperature coefficients of resistance diminishes with adsorption of gas and increases reversibly when the adsorbed gas is set free again. The resistance of thicker layers with positive temperature coefficients of resistance, however, increases with gas adsorption and decreases on degassing. At low temperatures the effect is much more pronounced and the adsorption greater.

621.385.832 **2787**

Application of a Variation Method to the Theory of the Electric and Magnetic Deflection of Electron Beams.—W. Glaser. (*Ann. Phys., Lpz.*, 6th May 1949, Vol. 4, No. 7, pp. 389–408.) The principal results of a previous paper (1577 of 1939; corrections, 2168 of 1941) are summarized and it is shown that the results of Picht & Himpan for the electric deflection of electron beams (3091 of 1941) are included as a particular case of the author's more general theory, when this is limited to purely electric deflection and stray lateral fields are absent.

538.1 : 538.56 **2788**

Elements of Electromagnetic Waves. [Book Review]—L. A. Ware. Publishers: Pitman & Sons, London, 203 pp., 20s. (*Wireless Engr*, July 1949, Vol. 26, No. 310, p.245.) Intended to meet the need for an elementary introduction to the basic ideas of electromagnetic theory; essentially mathematical in character and assumes a knowledge of calculus and fundamental a.c. theory.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.53 : 621.396.9 **2789**

Radio Doppler Investigation of Meteoric Heights and Velocities.—Manning, Villard & Peterson. (*See* 2801.)

550.372 : 621.317.3 **2790**

Ground-Conductivity Measurements in Schleswig-Holstein.—Grosskopf. (*See* 2832.)

551.510.535 **2791**

On Magnetic Triple Splitting in the Ionosphere.—W. Dieminger & H. G. Möller. (*Naturwissenschaften*, May 1949, Vol. 36, No. 2, pp. 56–57.) Triple splitting is frequently observed in high latitudes, but observations at Lindau über Northeim show that it sometimes occurs in medium latitudes. The third component f_z has only been observed there when the f_0 and f_x components show no definite limiting frequencies, but are split up into many lines, giving a feathery effect on the record. The f_z component then appears as a single line. Sometimes the feathering is so wide that f_z disappears within it. These effects occur during winter nights. Explanations are suggested.

551.510.535 **2792**

The Ionosphere over Mid-Germany in May 1949.—Dieminger. (*Fernmeldetech. Z.*, July 1949, Vol. 2, No. 7, p. 223.) Continuation of 2519 of September. Abnormal values of critical frequencies are noted.

551.510.535 **2793**

The Influence of Vertical Ionic Drift on a "Chapman Region".—C. B. Kirkpatrick. (*Aust. J. sci. Res., Ser. A*, Dec. 1948, Vol. 1, No. 4, pp. 423–442.) A theoretical discussion of an ionized region in which ion production and decay occur. Methods of computing the electron density are evolved for both moving and static layers. The effect of ion drift is investigated for conditions corresponding to those of the E layer and the solar atmospheric tide, and the departure from normal Chapman behaviour is determined.

551.510.535 : 621.396.11 **2794**

The Longitude Effect of the F_2 Ionospheric Layer and Ionosphere Forecasting.—F. Oboril & K. Rawer (*C. R. Acad. Sci., Paris*, 20th June 1949, Vol. 228, No. 25, pp. 1962–1963.) The world zonal divisions decided on at the 1944 international radio-propagation conference at Washington are found unsatisfactory, particularly for radio links with Africa. Comparisons between results obtained at various stations situated in different parts of the world, but with approximately the same latitudes, indicate that the F_2 layer in Africa and in Europe corresponds closely to that in Asia. It is not correct to assign Africa and Europe to zone I; they belong properly to zone E. The Washington decisions were based on idealized geomagnetic coordinates, but between these and the actual geomagnetic data there is a very pronounced difference. The real geomagnetic equator, given by zero inclination, is well to the north of the geographic equator for both Africa and Asia. If a magnetic control of the ionospheric ionization actually exists, it should be related to the true geomagnetic distribution. It is suggested that a better zonal distribution would be as follows:— zone W, between 40°W and 100°W; zone E, between 0° and 160°E. Europe and the greater part of Africa would thus belong to zone E and zone I would include mainly the Atlantic and Pacific Oceans.

551.510.535 : 621.396.11 **2795**

The Investigation and Forecasting of Ionospheric Conditions.—Appleton. (*See* 2894.)

551.510.535(98) **2796**

Observations made on the Ionosphere during Operations in Spitsbergen in 1942-43.—A. B. Whatman. (*Proc. phys. Soc.*, May 1949, Vol. 62, No. 353B, pp. 307–320.) The observations were made between 12th Oct. 1942 and 8th June 1943. (h', f) observations were taken with an early model of Admiralty equipment Type 249, described in 2240 of 1948 (Thomas & Chalmers). Each region of the ionosphere is considered in turn; the same main regions are found as elsewhere, but there are many abnormalities, including the 'polar spur'. Ionization often changes very rapidly. The effects of magnetic storms are described.

551.594.21 : 621.396.822 **2797**

Electromagnetic Noise of Thunderclouds.—Y. Rocard & J. L. Steinberg. (*C. R. Acad. Sci., Paris*, 20th June 1949, Vol. 228, No. 25, pp. 1960–1962.) The principles used by Haeff in the electron-wave valve (1825 of June) may explain qualitatively certain effects observed by the authors and concerned with (*a*) the unexpected amplification of broadcasting signals, and (*b*) the u.h.f. radio noise from thunderclouds. A solar-noise recorder operating on 1 200 Mc/s, when its parabolic aerial was directed toward a thundercloud, registered a power of 6×10^{-22} W per cycle per m² of aerial receiving surface, corresponding to numerous packets of noise radiation each lasting from a few seconds to half a minute. On another occasion a thundercloud gave noise packets more detached from one another and lasting longer, but not more than a minute, with a mean power of 4×10^{-22} W/cycle/m². In the same conditions the solar noise radiation on the same frequency was very steady, with a power of 25×10^{-22} W/cycle/m².

551.594.221 **2798**

Experimental Investigations of Resistance and Power within Artificial-Lightning Current Paths.—H. Norinder & O. Karsten. (*Ark. Mat. Astr. Fys.*, 9th May 1949, Vol. 36, Part 4, Section A, No. 16, 48 pp. In English.) Apparatus and methods are fully described. Calculations based on the experimental results indicate that the internal resistance of a lightning path of length 1 km is of the order of 200 Ω. With the added resistances of branch paths within the cloud it would thus appear that only aperiodic or quasiperiodic lightning discharges can occur. This conclusion is fully borne out by Norinder's c.r.o. observations.

551.594.221 : 621.315.23 **2799**

Lightning Current Observations in Buried Cable.—H. M. Trueblood & E. D. Sunde. (*Bell Syst. tech. J.*, April 1949, Vol. 28, No. 2, pp. 278–302.) An account of investigations in the territory round Atlanta, Georgia, during three seasons. The duration of lightning currents was found to be considerably longer than the average ordinarily assumed. The time to half-value of intense currents is of the order of 150 μs, with greater values for lower currents.

LOCATION AND AIDS TO NAVIGATION

534.321.9 : 526.956.5 **2800**

Indicating and Recording Echo Sounder PEK-3G.—S. von Melsted. (*Ericsson Rev.*, 1949, No. 1, pp. 10–16.) A magnetostriction 22-kc/s oscillator is used. The sounder has ranges of 0–100 m for coastal waters and 0–1 000 m for the open sea. Design, construction and operation are discussed. See also 2127 of 1948.

621.396.9 : 523.53 **2801**

Radio Doppler Investigation of Meteoric Heights and Velocities.—L. A. Manning, O. G. Villard, Jr, & A. M. Peterson. (*J. appl. Phys.*, May 1949, Vol. 20, No. 5, pp. 475–479.) A c.w. method, discussed theoretically by Manning (1392 of June), was tested during the 1948 Perseid meteor shower. Accuracy compares favourably with that of optical and other radio methods. Doppler methods have relatively great sensitivity.

621.396.932 **2802**

The Decca Navigator System.—(*Engineering, Lond.*, 13th May 1949, Vol. 167, No. 4346, pp. 439–442.) For another account see 1678 of June.

621.396.932 : 061.3 **2803**

Operational Aspects of Marine Radar.—(*J. Inst. Nav.*, April 1949, Vol. 2, No. 2, pp. 93–158.) The following papers were read at a symposium held at the Institute of Navigation on 18th Feb. 1949:—Operational Factors and Operational Yields, by E. Parker & L. S. Le Page. The Fitting and Use of Navigational Radar, by H. R. Whitfield, A. Harrison & T. J. Pope. Experience in Fitting Radar to Ships, by B. S. Millard. Constructing a Marine Radar to Operational Requirements, by B. R. Davies & L. W. Brown. Some Navigational Experience with Marine Radar, by O. S. Puckle. On Increasing the Radar Echoing Characteristics of Buoys and Small Boats, by A. L. P. Milwright. Charts and Chart Matching Devices, by P. G. Satow. The Operational Value of Shipborne Radar, by F. J. Wylie & M. W. Kaye. Methods of Using Shore-Based Harbour-Supervision Radar, by W. R. Colbeck. Shore-Based Radar as an Aid to the Operation of Ferries, by L. D. Price. Radar in Ships of the United States Lines [summary only], by A. H. Andrews. Some American Views on the Operation of Marine Radar [summary only], by E. J. Isbister & W. R. Griswold. The Present Outlook, by R. F. Hansford. The full papers are included except where otherwise indicated; some of them are discussed on pp. 138–142.

621.396.933 **2804**

The Multiple-Track Range.—M. Beard. (*Proc. Instn elect. Engrs*, Part III, May 1949, Vol. 96, No. 41, pp. 245–251.) A short-distance radio navigational aid similar in principle to Gee and Loran. Experimental equipment which was used near Sydney is described; accuracy and results of trials are discussed. See also 2527 of September (Downes).

621.396.933.23 : 621.315.2 **2805**

Landing Cable and its Possible Applications To-Day.—S. Ostrovidow. (*Onde élect.*, June 1949, Vol. 29, No. 267, pp. 255–267.) Experiments in France in the period between the two world wars are reviewed. The main points of the theory of the field of such cables carrying a.f. current are outlined and an automatic landing system is described.

621.396.9 : 621.385 **2806**

German Development of Modulator Valves for Radar Applications. [Book Notice]—B.I.O.S. Final Report No. 1746. H.M. Stationery Office, London, 26 pp., 3s.

MATERIALS AND SUBSIDIARY TECHNIQUES

535.37 **2807**

The Electron-Trap Mechanism of Luminescence in Sulphide and Silicate Phosphors.—J. S. Johnson & F. E. Williams: G. F. J. Garlick. (*Proc. phys. Soc.*, May 1949, Vol. 62, No. 353A, pp. 317–319.) Comment on work noted in 2801, 3080 and 3421 of 1948.

538.213 + 538.541] : 669-41 **2808**

Permeability and Eddy Currents in Sheet-Metal Cores at Very High Frequencies.—F. Feldtkeller. (*Frequenz*, April 1949, Vol. 3, No. 4, pp. 111–116.) The behaviour of the complex initial permeability at low and at high frequencies differs, in general, from that calculated for homogeneous sheet. The difference can be explained by assuming different values for the local initial permeability (*a*) within the material and (*b*) near the surface. The change of the initial permeability from the surface to the middle is calculated from the values of the complex permeability.

538.22 **2809**

Nonmetallic Materials developed with Improved Magnetic Properties.—(*Materials and Methods*, June 1949, Vol. 29, No. 6, pp. 54–55.) The properties of ferrites, including various grades of 'ferroxcube' made by the Philips Co., are described. Important features are high resistivity, high permeability and low losses.

538.245 **2810**

A Recent Development in Soft Magnetic Materials.—H. H. Scholefield. (*J. sci. Instrum.*, June 1949, Vol. 26, No. 6, pp. 207–209.) The development, manufacture, structure and properties of a new Ni-Fe material, 'H.C.R.', having a rectangular hysteresis loop and suitable for magnetic-amplifier and heavy-current mechanical-rectifier circuits.

546.289 : 537.311.33 **2811**

The Electrical Conductivity of Germanium.—E. H. Putley. (*Proc. phys. Soc.*, May 1949, Vol. 62, No. 353A, pp. 284–292.) Experimental results are described and are explained by the theoretical calculations of Shifrin (2218 of 1946). The concentration of impurity centres and of thermally excited electrons and the position of the impurity levels are deduced.

549.514.51 **2812**

Production of Large Artificial Quartz Crystals.—In 1964 of July please alter the name of the second author to M. Huot de Longchamp.

620.197.19 **2813**

A New Moisture-Sealing Compound.—W. B. R. Agnew. (*Electronics*, July 1949, Vol. 22, No. 7, pp. 165..168.) A mixture of 60% Gilsonite and 40% Hydrolene has satisfactory sealing properties, and is neither brittle at −55°C nor soft at +90°C. Gilsonite is a natural asphaltum mined in Utah; Hydrolene is the trade name of a Standard Oil Co. brand of petroleum asphaltum.

621.315.59 + 621.314.63 **2814**

Semi-Conductors and Rectifiers.—N. F. Mott. (*Engineering, Lond.*, 3rd June 1949, Vol. 167, No. 4349, pp. 510–511.) Long summary of the 40th Kelvin lecture. General discussion of the mechanism of conduction in both excess and defect semiconductors and of the theory of rectification.

621.315.616 **2815**

Developments in Insulating Materials.—C. G. Garton. (*Elect. Rev., Lond.*, 15th July 1949, Vol. 145, No. 3738, pp. 93–96.) Terylene (poly-ethylene-terephthalate), a new filament-forming material, is not yet commercially available but promises to provide strong insulating fabrics little affected by either temperature or humidity. It is stable at 150°C and combines toughness with flexibility from sub-zero temperatures up to 60° or 70°C.

P.T.F.E. (poly-tetrafluor-ethylene) has the same low dielectric constant as polyethylene, does not soften or decompose at 250°C and is chemically inert. Although difficult to mould, it can be sintered and has been produced in thin films.

P.C.T.F.E. (poly-chlor-trifluor-ethylene) can be moulded. It has mechanical and thermal properties intermediate between polyethylene and P.T.F.E., but a higher dielectric loss.

621.318.22 : 621.775.7 **2816**

Magnets from Pure Iron Powder.—R. Steinitz. (*Metal Progress*, June 1949, Vol. 55, No. 6, pp. 858..868.) The properties of iron powder consisting of particles of colloidal size (0.2 μ or less) are quite different from those of solid iron. Magnets have been made in fairly large quantities from such iron powder by the Société d'Électrochimie, d'Électrometallurgie et des Aciéries Électriques d'Ugine, Grenoble, France, and much theoretical work has been done by Néel (3151 and 3152 of 1947). The powder is produced by the decomposition and reduction of iron formates. The method used for the production of magnets could be applied to other metals and to certain alloys. See also 1053 of 1948 (Stoner & Wohlfarth).

621.775.7 **2817**

Powder Metallurgy.—Nguyen Thien-Chi. (*Ann. Radioélect.*, July 1949, Vol. 4, No. 17, pp. 233–248.) General principles, with examples of their application for the production of refractory pseudo-alloys, cupronickel, permanent magnets, alloys for welding to glass, special types of cathode etc.

549.514.51 **2818**

Etch and Percussion Figures, and Twinning of Quartz. [Book Notice]—N. N. Padurow. F.I.A.T. Final Report No. 1098. H.M. Stationery Office, London, 41 pp., 7s. 6d.

620.179: 621.38/.39 **2819**

Electronic Principles as applied in Germany to the Testing of Materials. [Book Notice]—B.I.O.S. Final Report No. 724. H.M. Stationary Office, London, 194 pp.

621.315.59 + 621.314.6 **2820**

German Research on Rectifiers and Semi-Conductors. [Book Notice]—B.I.O.S. Final Report No. 725. H.M. Stationery Office, London, 52 pp.

621.315.612 : 621.319.4 **2821**

Ceramic Dielectrics for Condensers. [Book Notice]—F.I.A.T. Final Report No. 892. H.M. Stationery Office, London, 14 pp., 2s.

MATHEMATICS

518.5 : 681.142 **2822**

Calculating Machines.—In future the U.D.C. number 681.142 will be used for calculating machines, in preference to the number 518.5 used hitherto.

681.142 **2823**

Programme Design for a High-Speed Automatic Calculating Machine.—M. V. Wilkes. (*J. sci. Instrum.*, June 1949, Vol. 26, No. 6, pp. 217–220.) Problems to be solved by means of a digital machine must first be reduced to a series of arithmetical operations. These must then be expressed in the code appropriate to the machine. This process is discussed with special reference to the EDSAC (3448 of 1948). Simple examples are given, specially designed to illustrate the use of conditional orders and the way in which arithmetical operations may be performed.

681.142 **2824**

Electronic Analogue Computers.—D. Fidelman. (*Radio and Television News, Radio-Electronic Engng Supplement*, Dec. 1948, Vol. 11, No. 12, pp. 3–6..30 & Jan. 1949, Vol. 12, No. 1, pp. 16–19, 30.) General design, and specific circuits and techniques used in the solution of equations.

681.142 : 681.17 **2825**

Electronic Computer Applications.—Fidelman. (*See* 2886.)

51(083.5) **2826**

Tafeln höherer Funktionen. (Tables of Higher Functions) [Book Review]—Jahnke-Emde. B. G. Teubner, Leipzig, 4th edn 1948, 300 pp., 11.80 DM. (*Frequenz*, April 1949, Vol. 3, No. 4, p. 121.) Text in German and English. The 1938 edition has been enlarged by the inclusion of some spherical and cylindrical functions. Many savants have assisted, by corrections and additions, in enhancing the well-known reliability and manysidedness of the work.

517.43 : [5+6 **2827**

Operatorenrechnung nebst Anwendungen in Physik und Technik. (Operational Calculus with Applications in Physics and Technics) [Book Review]—K. W. Wagner. J. A. Barth, Leipzig, 1940, 448 pp., 29.60 RM. (*Akust. Z.*, May 1941, Vol. 6, No. 3, pp. 195–196.) After an introduction which includes an appreciation of the work of Heaviside, the general Laplace transformation and its operational laws are considered. The presentation is very clear. An excellent treatment of problems of low-current technics is given, including the theory of coupled systems, simple filter circuits, etc. Problems of mechanics and heat are also considered.

518.2 (083.5) **2828**

Tafeln elementarer Funktionen. (Tables of Elementary Functions) [Book Review]—F. Emde. B. G. Teubner, Leipzig, 2nd edn 1948, 181 pp., 11.60 DM. (*Frequenz*, April 1949, Vol. 3, No. 4, p. 121.) Text in German and English. An almost unaltered reprint of the 1940 edition. The tables are principally intended for the use of the engineer and physicist.

MEASUREMENTS AND TEST GEAR

531.761 **2829**

A Simplified Chronotron-Type Timing Circuit.—J. W. Keuffel. (*Rev. sci. Instrum.*, March 1949, Vol. 20, No. 3, pp. 197–201.) The chronotron was noted in

762 of 1948 (Neddermeyer et al.). The arrangement here discussed has a parallel-wire polythene-tape line, Ge-crystal detectors, and a delay-line presentation circuit in which a single amplifier is used for all pulses. Accuracy is within 10^{-9} sec.

531.761 **2830**

Electronic Timing Test Set.—M. E. Krom. (*Bell Lab. Rec.*, May 1949, Vol. 27, No. 5, pp. 176–180.) Time intervals are indicated directly by a valve voltmeter across a capacitor charged from a constant-current source. Ranges are 0–20 ms, 0–100 ms, 0–500 ms and 0–5 sec.

531.764 : 621.316.7 **2831**

Automatic Synchronous Clock and Time Control.—(*Engineer, Lond.*, 20th May 1949, Vol. 187, No. 4869, p. 566.) Improved equipment similar to that noted in 761 of 1948.

621.317.3 : 550.372 **2832**

Ground-Conductivity Measurements in Schleswig-Holstein.—J. Grosskopf. (*Fernmeldetech. Z.*, July 1949, Vol. 2, No. 7, pp. 211–218.) The results of numerous measurements show close correlation with the well-defined geological surface formations, so that conductivities can be found approximately from a geological map. A semi-graphical method is given for determining, from known ground conductivity, the field-strength distribution of a transmitter at a particular place. In the medium-wave band and in flat country, reflections at slight surface irregularities are possible.

621.317.3 : 621.396.621 : 621.396.822 **2833**

Technique of Noise Measurement for U.H.F. Receivers.—G. Naday. (*Ann. Radioélect.*, July 1949, Vol. 4, No. 17, pp. 257–260.) The various factors contributing to background noise in radar receivers are enumerated and simple methods of measuring them are described. A formula is given for calculating the receiver noise factor from the results of the measurements.

621.317.335.2† : 621.319.45 **2834**

A Simple Arrangement for Measuring the Capacitance of Electrolytic Capacitors.—W. Schmitz. (*Funk u. Ton*, June 1949, Vol. 3, No. 6, pp. 311–314.) A d.c. instrument is used to measure the voltage across the capacitor, which is charged through a half-wave rectifier from an a.c. source. Use of a shunt resistor of suitable value enables the meter scale to be calibrated directly in microfarads.

621.317.33 + 621.317.78].029.62 **2835**

An Impedance and Power Meter for the 144-Mc/s Band.—H. A. M. Clark. (*R. S. G. B. Bull.*, July 1949, Vol. 25, No. 1, pp. 6–11, 19.) The impedance to be measured is used to terminate an accurately constructed $\lambda/4$ section of air-dielectric 70-Ω coaxial line into which a 145-Mc/s signal is fed. Diode probes are used to measure the voltage on the line at the end and at two points respectively $\lambda/8$ and $\lambda/4$ from the end. The resistive and reactive components of the impedance and the power delivered to it may then be calculated or derived from charts. For indications of mismatch and power measurements the instrument may be permanently connected to a coaxial feeder. Details of construction are given.

621.317.34 + 621.317.373 **2836**

A Precise Direct-Reading Phase and Transmission Measuring System for Video Frequencies.—D. A. Alsberg & D. Leed. (*Bell Syst. tech. J.*, April 1949, Vol. 28, No. 2, pp. 221–238.) Equipment which compares, with respect to phase and amplitude, the outputs of two channels energized from the test oscillator, one channel serving as a standard and the other containing the network to be tested. A heterodyne method is used to transfer the phase and insertion-loss of the network from the variable test-frequency to a constant i.f. of 31 kc/s at which the phase and insertion-loss standards operate. The test-frequency range is 50–3 600 kc/s. A slave oscillator automatically tracks at a constant frequency-difference of 31 kc/s from the master oscillator. The special features of the various units of the equipment, including oscillators, modulators, phase detector, phase shifter and attenuator, are described.

621.317.34 : 621.396.82 **2837**

A Simple Method of Measuring Small Swings and Modulation Indices of Frequency- or Phase-Modulated Hum and Noise.—W. W. Boelens & F. L. H. M. Stumpers. (*Commun. News*, Jan. 1949, Vol. 10, No. 1, pp. 15–19.) Hum and noise can be determined directly from a h.f. signal with the aid of a special converter stage and some filters. Measurements are made with a c.r.o.; the hum from the signal can easily be distinguished from that of other sources. The modulation index is found as the ratio of a measured quantity to a constant of the equipment; the frequency swing can be deduced.

621.317.361 **2838**

Accurate Frequency Measurement.—W. F. Brown. (*Wireless Engr*, July 1949, Vol. 26, No. 310, pp. 218–229.) A proposed method for use from 100 Mc/s to 12 000 Mc/s, with an error not exceeding 5 parts in 10^6 at 5 000 Mc/s. The frequency difference between the unknown and a crystal-checked harmonic of a variable oscillator (300–600 Mc/s) is measured by means of an i.f. amplifier (40–80 Mc/s) to which an i.f. oscillator is ganged for the production of an audible beat.

621.317.372 **2839**

Q-Meter Controversy.—E. D. Hart. (*Wireless World*, July 1949, Vol. 55, No. 7, p. 276.) Further comment on 1121 of April (Spratt). See also 2267 of August.

621.317.382.089.6 **2840**

The Absolute Measurement of Low Power at 3 000 Mc/s.—R. Street. (*Proc. Instn elect. Engrs*, Part III, May 1949, Vol. 96, No. 41, pp. 237–242.) A general method is described in which a constant-flow calorimeter of measured insertion-loss is used for the calibration of cm-λ milliwattmeters. Results of measurements on milliwattmeters using bolometer lamps, thermojunctions and thermistors are given. Reprinted, *ibid.*, Part II, June 1949, Vol. 96, No. 51, pp. 391–396.

621.317.411† **2841**

On the Measurement of Magnetic Permeability at Ultra-High Frequency.—J. Soutif-Guicherd & P. Grivet. (*C. R. Acad. Sci., Paris*, 8th June 1949, Vol. 228, No. 23, pp. 1796–1797.) Bernier has shown that so long as the diameter of the central conductor of a coaxial resonator is more than 10 times the skin thickness, the displacement $d\lambda$ of the natural wavelength of the resonator from its normal value λ_0 when the radius of the central conductor is large, is directly proportional to the square root of the permeability of the material of the central conductor. The Q factor is equal to $\lambda_0/d\lambda$. Experiments using a central ferro-nickel wire of diameter 0.5 mm verified these results qualitatively for a resonator for which $\lambda_0 = 3$ cm. Permeability variations were obtained by application of a constant magnetic field of several hundred gauss to the central wire.

621.317.7 : 06.064 **2842**

Measurement Apparatus at the [1949] **Paris Fair.**—J. Rousseau. (*T.S.F. pour Tous*, July/Aug. 1949, Vol. 25, Nos. 249/250, pp. 265–266.) Brief descriptions of selected exhibits.

621.317.715 **2843**

Coil Galvanometers with some Novel Features.—G. Ising. (*Ark. Mat. Astr. Fys.*, 4th May 1949, Vol. 36, Part 3, Section A, No. 13, 15 pp. In English.) Details of two small sensitive galvanometers, one termed a sphere galvanometer and the other a toroid galvanometer on account of the shape of the iron pole-pieces within the moving coil. The weight of the coil system does not exceed 200 mg and may be much less. The period of the sphere galvanometer is usually between 0.1 sec and 4 sec; that of the toroid type, with its two coils at the ends of a light cross arm, may be as much as 20 sec. For geophysical measurements both types may be mounted in gimbals.

621.317.715 : 621.395.645 **2844**

A Galvanometer Amplifier.—B. Frankenhaeuser & D. K. C. MacDonald. (*J. sci. Instrum.*, May 1949, Vol. 26, No. 5, pp. 145–147.) Series feedback into a light-beam galvanometer with differential photocell stabilization enables nerve potentials of 1–2 μV to be recorded.

621.317.723.082.742 : 621.386.82 **2845**

A Direct-Reading Dynamic Electrometer.—J. van Hengel & W. J. Oosterkamp. (*Philips tech. Rev.*, May 1949, Vol. 10, No. 11, pp. 338–346.) The unknown d.c. voltage is applied to a parallel-plate capacitor, one plate of which vibrates periodically, thereby producing an a.c. voltage. This is amplified in a conventional negative-feedback circuit and the rectified output voltage is registered by a moving-coil meter. Two instruments are described: a millivoltmeter (full scale 100 mV) and a dosimeter for X-rays. Each has an apparent input resistance $>10^5\ \Omega$, and input capacitance 40 pF.

621.317.733 **2846**

A Wide-Range Capacitance/Conductance Bridge.—R. H. Cole & P. M. Gross, Jr. (*Rev. sci. Instrum.*, April 1949, Vol. 20, No. 4, pp. 252–260.) For measurement by direct balance in the frequency range 50 c/s–5 Mc/s. Two circuits developed from the work of Starr (1933 Abstracts, p. 110) and Young (1134 of 1947) are used.

621.317.733 **2847**

Design Factors in a Capacity Bridge of High Accuracy.—C. A. Parry. (*Commun. Rev.*, Sept. 1948, Vol. 1, No. 4, pp. 27–41.) Detailed discussion of the design of a bridge using the hybrid-coil method of measuring impedances. Formulae are derived giving the limits of accuracy attainable. Indicator performance requirements are also considered.

621.317.733 : 629.135.052 **2848**

A Direct-Capacitance Aircraft Altimeter.—W. L. Watton & M. E. Pemberton. (*Proc. Instn elect. Engrs*, Part III, May 1949, Vol. 96, No. 41, pp. 203–210. Discussion, pp. 210–213.) Two insulated metal electrodes are mounted on the aircraft and an a.f. measurement is made of the direct capacitance between them. This capacitance is affected by the earth and the resulting very small capacitance variations are measured in the presence of other larger capacitances by the double-ratio a.c. bridge discussed in 2850 below, which can be made sensitive to changes of 1 μpF. Summary noted in 1126 of April. Reprinted *ibid.*, Part II, June 1949, Vol. 96, No. 51, pp. 379–386. Discussion, pp. 386–389.

621.317.733.029.3 **2849**

The Maxwell Bridge at Low Frequencies.—V. A. Brown & B. P. Ramsay. (*Rev. sci. Instrum*, April 1949, Vol. 20, No. 4, pp. 236–239.) The bridge can be used to measure inductance and a.c. resistance at periods from 0.01 sec to 200 sec. The effect of induced currents in inductor core material upon the bridge circuit is discussed.

621.317.733.3 **2850**

Double-Ratio A.C. Bridges with Inductively-Coupled Ratio Arms.—H. A. M. Clark & P. B. Vanderlyn. (*Proc. Instn elect. Engrs*, Part III, May 1949, Vol. 96, No. 41, pp. 189–202. Discussion, pp. 210–213.) Part 1, which is the original work of the late A. D. Blumlein, is concerned with the theory of bridges having ratio arms consisting of tightly coupled inductors. With such arms, the direct impedance between two points can be measured independently of any indirect impedances between a third point and the two terminals of the impedance being measured. When two sets of of such ratio arms are combined, the bridge can be used for very large ratios of the unknown and standard impedances.

Part 2 describes a general-purpose mutual-admittance bridge for a wide range of capacitance and resistance measurement. Components can be measured in situ, without isolating them from other components of a circuit, when this bridge is used. Summary noted in 1126 of April. Reprinted *ibid.*, Part II, June 1949, Vol. 96, No. 51, pp. 365–378. Discussion, pp. 386–389.

621.317.74.029.64 : 621.396.67 **2851**

A New Type of Slotted-Line Section.—Wholey & Eldred. (*See* 2716.)

621.317.755 : 621.317.373 **2852**

The Measuring of Phase Angles with an Oscillograph.—L. Hintzbergen. (*Microtecnic, Lausanne*, March/April 1949, Vol. 3, No. 2, pp. 61–67.) The elements whose phase difference is to be measured are connected respectively to the horizontal and vertical deflection plates of the c.r.o., and the phase relation is deduced from the shape of the ellipse displayed.

621.317.755 : 621.317.791 **2853**

Vector Voltage Indicator.—P. G. Sulzer. (*Electronics*, June 1949, Vol. 22, No. 6, pp. 107–109.) For another account see 2569 of September.

621.317.761 : 621.317.755 : 621.396.615.17 **2854**

A Circular-Time-Base Frequency Comparator.—T. W. R. East & A. F. Standing. (*J. sci. Instrum.*, July 1949, Vol. 26, No. 7, pp. 236–239.) Principles and practical design.

621.317.763.029.64 : 621.396.611.4 **2855**

A 10-cm Mechanically Swept Spectrometer.—P. Andrews. (*Proc. Instn elect. Engrs*, Part III, May 1949, Vol. 96, No. 41, pp. 254–256.) A hybrid H_{011} coaxial-mode cavity is tuned by a motor over a frequency range of ± 8 Mc/s once every 2 sec at any predetermined point in the 3 000-Mc/s band. For monitoring a pulsed transmitter, the output pulses from the cavity are rectified, lengthened, amplified and used to give a vertical deflection on a c.r. tube, the horizontal deflection being controlled by a potentiometer driven by the frequency-sweep motor. Accuracy is within about $\frac{1}{4}$ Mc/s. See also 1130 of April (Allan & Curling).

621.317.772 : 621.317.2 **2856**

Phase Meter for Laboratories and Test Departments.—G. Grübel. (*Funk u. Ton*, June 1949, Vol. 3, No. 6, pp. 315–319.) Two voltages, V_1, V_2, of the same frequency and nearly equal amplitudes, are applied through identical transformers across two bridges, each of which includes a variable capacitor. The voltages developed across the other diagonals of the bridges are applied between grid and cathode in a symmetrical arrangement of two triodes, whose output voltages feed the deflection plates of a c.r.o. The variable capacitors are mechanically coupled so that the capacitance of one increases as that of the other decreases, and the phase difference between V_1 and V_2 is given directly on a calibrated scale when phase equality is indicated on the c.r.o. Theory of the method is given, optimum values of the circuit components are indicated and full details of the calibration of the capacitor scale are tabulated.

621.317.79 : 621.396.615.12 **2857**

Generator for A.F. Measurements.—W. N. Eldred. (*FM-TV*, June 1949, Vol. 9, No. 6, pp. 31..38.) Description of the Hewlett-Packard a.f. signal generator Type 206A. The output voltage has a known amplitude and is transmitted at a known impedance level. Distortion is less than 1%. The basic accuracy depends only on the attenuator system ; the indicating meter is only required to be sensitive to small changes of signal level.

621.317.79 : 621.396.619 **2858**

Modulation Meter with S-Scale and Combined Peak and Mean-value Indication.—K. H. R. Weber. (*Frequenz*, June 1949, Vol. 3, No. 6, pp. 179–181.) About half of the meter scale is used for the modulation range 0–10% and the divisions are more evenly spaced than is the case with a logarithmic scale. From 80% to 105% the scale is linear. The indicating instrument is of the moving-coil type, with a mirror mounted on the coil spindle to give luminous indications on the translucent scale. Basic principles are discussed and a circuit diagram is given, with details of the arrangements for checking the scale at four points.

621.317.79 : 621.396.712 **2859**

A.M. and F.M. Broadcast Station Measurements.—T. Downey. (*Electronics*, July 1949, Vol. 22, No. 7, pp. 89–93.) Discussion of routine operating checks and proof-of-performance measurements required by law for regular operation, and of new a.f. and noise measurements specified for a.m. transmitters.

621.317.794 **2860**

Measurement of Centimetre-Wave Power by means of Bolometers.—J. Broc. (*C. R. Acad. Sci., Paris*, 20th June 1949, Vol. 228, No. 25, pp. 1937–1938.) For accurate measurement the conditions must be known under which equivalence is obtained between the heating of a bolometer wire by centimetre waves and by d.c. The temperature distribution along Pt wires of diameter from 1 μ to 3 μ was determined from the solution of a differential equation. The cooling along the wire depends appreciably on the gas pressure; pressures of 10^{-4} mm Hg or less are advantageous. A practical wattmeter for powers from 50 μW to 0.01 μW has been constructed and tested at $\lambda = 3.2$ cm. The lowest power measurable with this instrument is about 10 times less than that which can be measured with a thermistor, and the bolometer is about 100 times less sensitive to variations of the ambient temperature.

621.392.26 (083.74)† **2861**

Standard for Waveguides.—W. H. Fenn. (*Electronics*, June 1949, Vol. 22, No. 6, pp. 110–111.) Commercial standards for rectangular waveguides announced by the Radio Manufacturers Association. Inside and outside dimensions are tabulated, together with the frequency range of the dominant TE_{10} mode.

621.396.615.17 : 621.392.5 **2862**

The Pulse-Testing of Wide-Band Networks.—D. C. Espley, E. C. Cherry & M. M. Levy. (*Proc. Instn elect. Engrs*, Part III, May 1949, Vol. 96, No. 41, pp. 186–188.) Discussion on 1101 of 1948.

621.396.645.001.4 : 537.311.33 : 621.315.59 **2863**

Testing Transistors.—K. Lehovec. (*Electronics*, June 1949, Vol. 22, No. 6, pp. 88–89.) If all a.c. components are sufficiently small, the current through the emitter and that through the collector are linearly related to the voltages between each of these and the base. The four dynamic impedances which are the coefficients in these relations can be used to describe transistor operation; they are practically independent of frequency up to about 1 Mc/s. Test equipment is described which gives the direct currents and voltages of transistors at the operating point, corresponding a.c. values for zero and infinite collector load-resistance, and current and voltage amplification values. The impedance coefficients are then easily calculated.

621.396.9.001.4 : 621.314.25 **2864**

Incremental Phase Splitter.—E. Kasner. (*Electronics*, July 1949, Vol. 22, No. 7, pp. 94–95.) A range-simulator circuit which produces two signals of the same frequency but differing in phase from the original signal by fixed and equal amounts; it was developed for testing radar equipment.

621.317.3 + 621.317.7 **2865**

H.F. Instruments and Measuring Techniques. [Book Notice]—B.I.O.S. Final Report No. 1228. H.M. Stationery Office, London, 29 pp.

621.317.33 **2866**

High Frequency Measuring Techniques using Transmission Lines. [Book Review]—E. N. Phillips, W. G. Sterns & N. J. Gamara. Publisher: J. F. Rider, New York, 1947, 64 pp., $1.50. (*Proc. phys. Soc.*, May 1949, Vol. 62, No. 353B, p. 336.) An account of various techniques for measuring impedances and the electrical characteristics of h.f. cables.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.768 **2867**

A Magnetostrictive Acceleration Meter.—H. Wilde & E. Eisele. (*Z. angew. Phys.*, May 1949, Vol. 1, No. 8, pp. 359–366.) A device using a block of Ni stampings, cemented into a solid block with a thermoplastic cement and provided with a multi-turn coil. Calibration is effected by tests with the device mounted on a blunt-pointed carrier which is allowed to fall freely from various heights into sand. The measurement range can be varied within wide limits by changing the auxiliary mass attached to the stampings.

531.787.9 : 621.431 **2868**

Wide-Range Pressure Gauge for Explosion-Pressure Investigations [in internal-combustion engines].— W. Gohlke. (*Z. angew. Phys.*, May 1949, Vol. 1, No. 8, pp. 347–359.) Detailed description of a piezoelectric gauge using a highly-damped quartz disk, of natural frequency above 100 kc/s, mounted in the nose of the outer shell of a sparking plug. The associated wide-band amplifier and c.r.o. sweep circuit are also described and typical oscillograms obtained with the gauge at different points of an engine cylinder are reproduced.

534.321.9 : 620.179.16 **2869**

A Visual Method for Demonstrating the Path of Ultrasonic Waves through Thin Plates of Material.—C. J. Burton & R. B. Barnes. (*J. appl. Phys.*, May 1949, Vol. 20, No. 5, pp. 462–467.)

539.16.08 **2870**

Rejuvenation of Geiger-Müller Tubes.—L. Shepard. (*Rev. sci. Instrum.*, March 1949, Vol. 20, No. 3, pp. 217–218.) The central wire is heated to a dull red glow by an electric current for about 10 min during evacuation, before filling with new gas.

539.16.08 **2871**

On the Construction of Geiger-Müller Counters of the Metal Type.—M. Lesage, A. Rogozinski & A. Voisin. (*J. Phys. Radium*, June 1949, Vol. 10, No. 6, pp. 212–214.) Details of methods adopted at the cosmic-physics laboratory at Meudon observatory.

539.16.08 **2872**

Design and Performance of a Multicellular Geiger Counter for Gamma-Radiation.—D. A. Lind. (*Rev. sci. Instrum.*, April 1949, Vol. 20, No. 4, pp. 233–235.)

539.16.08 **2873**

Experiments on the Possibility of Increasing the Efficiency of Gamma[-ray] **Counters.**—H. Slätis. (*Ark. Mat. Astr. Fys.*, 9th May 1949, Vol. 36, Part 4, Section A, No. 17, 12 pp. In English.) The efficiency of G-M counters for recording γ-quanta can be increased by inserting systems of concentric metal rings between the wire and the cylinder. By means of a potentiometer, a voltage is applied to each system equal to the voltage existing there in the absence of any rings. A counter based on the above principle, with three 24-ring systems, had an efficiency 2.5 times that of a conventional counter of the same size, and also a smaller resolving time.

539.16.08 **2874**

The Effect of External Quenching on the Life of Argon-Alcohol Counters.—H. Elliot. (*Proc. phys. Soc.*, 1st June, 1949, Vol. 62, No. 354A, pp. 369–373.)

539.16.08 : 621.318.572 **2875**

Electronic Counters for Pulses.—P. Naslin & A. Peuteman. (*Onde élect.*, June 1949, Vol. 29, No. 267, pp. 241–54.) Essentially the same as 660 of March.

621.365.55† **2876**

H.F. Dielectric Heating.—G. Gregoretti. (*Elettrotecnica*, 10th/25th March 1947, Vol. 34, No. 3, pp. 80–85. Reprint.) A review of theory and fields of application, with brief indication of apparatus used. *Note.* The above U.D.C. number will in future be used for dielectric heating.

621.383.001.8 **2877**

Letter Reading Machine.—V. K. Zworykin, L. E. Flory & W. S. Pike. (*Electronics*, June 1949, Vol. 22, No. 6, pp. 80–86.) For another account see 2593 of September and back references.

621.384.6 **2878**

The Development of Electron Accelerators.—W. Graffunder. (*Helv. phys. Acta*, 30th June 1949, Vol. 22, No. 3, pp. 233–260. In German.) Theory of resonator methods of acceleration.

621.385.833 **2879**

Use of Marginal Rays in the Study of the Asymmetry of Electrostatic Lenses.—F. Bertein & E. Regenstreif. (*C. R. Acad. Sci., Paris*, 13th June 1949, Vol. 228, No. 24, pp. 1854–1856.)

621.385.833 **2880**

On the Aperture Errors of Electrostatic Electron Lenses.—H. Mahl & A. Recknagel. (*Z. Phys.*, 1944, Vol. 122, pp. 660–679.) Theoretical discussion and experimental results.

621.385.833 **2881**

Phase Contrast in Electron Microscope Images.—E. G. Ramberg. (*J. appl. Phys.*, May 1949, Vol. 20, No. 5, pp. 441–444.)

621.385.833 : 061.3 **2882**

Summarized Proceedings of Conference on Electron Microscopy: Cambridge — September 1948.—V. E. Cosslett. (*J. sci. Instrum.*, May 1949, Vol. 26, No. 5, pp. 163–169.)

621.396.9 : 621.867 **2883**

Metal Detector for Conveyors.—K. Urbach. (*Electronics*, July 1949, Vol. 22, No. 7, pp. 80–83.) Metal articles passing near the tank coil of a stable oscillator cause a change in oscillator output due to eddy-current, hysteresis and dielectric-loss changes. This change in output is detected, amplified, and used to actuate alarm or marker circuits.

621.398 : 621.396.621 **2884**

A Telecontrolled Tunable Receiver Installation: Part 2.—J. E. Benson & W. A. Colebrook. (*A.W.A. tech. Rev.*, April 1949, Vol. 8, No. 2, pp. 125–145.) The main difference between the installation here discussed and the earlier one noted in 466 of 1945 (Benson & Ross) is that the control functions are all performed over a single a.c. communication channel without a d.c. circuit. Coarse tuning, receiver change-over, and on/off switching of beat-frequency and calibration oscillators are performed by fixed-frequency tones. Fine tuning over ± 5 kc/s from any coarse-tuning position, r.f. gain and telemetering of the coarse-tuning setting are performed by tones of variable frequency.

621.785.5 **2885**

Surface Hardening of Metals using H.F. [induction] **Currents.**—C. Egidi. (*Ingegnere*, Sept. 1947, Vol. 21, No. 9, pp. 627–630. Reprint.) A general introduction covering the physical and technical principles involved.

681.142 : 681.17 **2886**

Electronic Computer Applications.—D. Fidelman. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, March & April 1949, Vol. 12, Nos. 3 & 4, pp. 3–6..27 & 6–9.) Various methods of using both digital and analogue computers for the solution of engineering problems, such as those connected with gun laying, and for automatic process-control in industry.

621.316.7 + 621.38.001.8 **2887**

Industrial Electronic Control. [Book Notice]—B.I.O.S. Final Report No. 1198. H.M. Stationery Office, London, 39 pp.

621.365 **2888**

High Frequency Heating. [Book Notice]—B.I.O.S. Final Report No. 866. H.M. Stationery Office, London, 32 pp.

621.38/.39 **2889**

Advances in Electronics: Vol. 1. [Book Review]—L. Marton (Ed.). Academic Press, New York; H. K. Lewis & Co., London, 1948, 475 pp., $9.00. (*Nature, Lond.*, 11th June 1949, Vol. 163, No. 4154, pp. 893–894.) A new publication analagous to *Rep. Progr. Phys.*, dealing with the physics of electrons in the free state and engineering applications of a fundamental character. Future volumes will have European as well as American contributors. This volume includes articles by various authors on electron emission, beam deflection, television pickup tubes, accelerators, the ionosphere, cosmic noise, wave propagation in the f.m. broadcasting band and navigation aids.

621.38 **2890**

Electronics. [Book Review]—F. G. Spreadbury. Publisher: Pitman, London, 698 pp., 55s. (*Proc. phys. Soc.*, May 1949, Vol. 62, No. 353A, p. 321.) Many aspects of the subject are covered. A knowledge of elementary physics and mathematics is assumed. "... there is much in the book that engineers will find of value. It is not likely to appeal to physicists."

621.384.611.1† **2891**

European Electron Induction Accelerators. [Book Notice]—B.I.O.S. Miscellaneous Report No. 77. H.M. Stationery Office, London, 68 pp., 6s. 6d.

PROPAGATION OF WAVES

538.566 **2892**

Propagation of Electromagnetic Waves above the Ground. Solution of the Problem of the Surface Wave.—T. Kahan & G. Eckart. (*J. Phys. Radium*, May 1949, Vol. 10, No. 5, pp. 165–176.) A detailed discussion of (*a*) Sommerfeld's treatment of the radiation of a dipole over ground of finite conductivity and (*b*) Wehl's treatment as simplified by Noether, shows that the two are essentially the same except that Sommerfeld overlooked a factor which completely annuls the so-called surface wave. Contrary to the view expressed by Epstein (4007 of 1947), the problem is determinate and unique. Epstein's argument shows, however, that the surface wave cannot be included in the solution. Experimental results confirm these theoretical conclusions. See also 951 of April.

538.566 **2893**

On the Normal Propagation of Electromagnetic Waves in Media with Any Type of Stratification.—F. Abelès. (*Rev. d'Optique*, May 1949, Vol. 28, No. 5, pp. 279–287.) The equations governing propagation in stratified media are derived and two invariants of the equations are pointed out. One of these leads very simply to general formulae for the case of piles of plates with parallel faces. Herpin (3865 of 1947) has shown that a system of thin layers is equivalent to two thin layers but not to a single thin layer. Matrix theory explains this, for the matrix of a single thin layer is reversible and keeps the same form when the input and output are interchanged and the direction of propagation is reversed. This is not true for a system of thin layers.

Analogies are pointed out between the propagation equations for stratified media and (*a*) those for transmission lines, (*b*) the canonical equations of mechanics.

621.396.11 : 551.510.535 **2894**

The Investigation and Forecasting of Ionospheric Conditions.—E. V. Appleton. (*Proc. Instn elect. Engrs*, Part III, May 1949, Vol. 96, No. 41, pp. 213–214.) Discussion on 2048 of 1948.

621.396.11 : 551.510.535 **2895**

The Longitude Effect of the F_2 Ionospheric Layer and Ionosphere Forecasting.—Oboril & Rawer. (*See* 2794.)

621.396.11 : 551.510.535 **2896**

Measurement of the Maximum Usable Frequency on Ionospheric Paths.—E. Harnischmacher. (*C. R. Acad. Sci., Paris*, 20th June 1949, Vol. 228, No. 25, pp. 1936–1937.) An account of results obtained during February and March 1948 at Freiburg, where the F_2 critical frequency was measured a few minutes before recording the hourly ionosphere-sounding signals from Lindau, 430 km away. After correction for the F_2-layer horizontal ionization gradient, the mean value of the ratio of the m.u.f. to the critical frequency at the midpoint of the path was found to be 1.127 for the day and 1.062 for the night.

621.396.812.029.62(94) **2897**

Radio Superrefraction in the Coastal Regions of Australia.—F. J. Kerr. (*Aust. J. sci. Res., Ser. A*, Dec. 1948, Vol. 1, No. 4, pp. 443–463.) A survey based on systematic war-time observations on 200 Mc/s at Royal Australian Air Force coastal radar stations. The strengths of permanent echoes were observed at hourly intervals over periods up to 18 months. Results are analysed in the light of meteorological conditions. See also 516 of 1947 (Booker) and T.R.E. Report T.1820, the latter being a special survey of Australian radio-climatology.

RECEPTION

621.396.1 : 621.396.5 **2898**

Double-Diversity Equipment for the Reception of Single-Sideband Radiotelephony.—A. Sev. (*Ann. Radioélect.*, July 1949, Vol. 4, No. 17, pp. 261–264.) The basic principles of diversity reception are outlined and the main features are described of the system developed by the Société française Radioélectrique. In this system, the reference level in the two channels is furnished by the mean level of the carrier wave, so that the change-over is independent of the modulation transmitted by the sidebands.

621.396.621 **2899**

Redifon Model R50.—(*Wireless World*, July 1949, Vol. 55, No. 7, pp. 251–254.) Test report and circuit details for a wide-range tropicalized communications receiver.

621.396.621 **2900**

Sensitivity of Receivers, with Complex Internal Resistance of the Generator (Aerial).—H. Behling. (*Frequenz*, April 1949, Vol. 3, No. 4, pp. 93–101.) The signal/noise ratio is calculated for single-stage and 2-stage receiver input circuits connected to the aerial; results are presented graphically. An example illustrates the compromise usually necessary between selectivity and sensitivity. Formulae are given for determining the selectivity corresponding to any given value of sensitivity.

621.396.621 : 621.396.822 : 621.317.3 **2901**

Technique of Noise Measurement for U.H.F. Receivers.—Naday. (*See* 2833.)

621.396.621 : 621.398 **2902**

A Telecontrolled Tunable Receiver Installation: Part 2.—Benson & Colebrook. (*See* 2884.)

621.396.82 : 621.317.34 **2903**

A Simple Method of Measuring Small Swings and Modulation Indices of Frequency- or Phase-Modulated Hum and Noise.—Boelens & Stumpers. (*See* 2837.)

621.396.621 **2904**

Lehrbuch der Funkempfangstechnik. (Manual of Radio Reception Technique). [Book Review]—H. Pitsch. Publishers: Geest & Portig K.-G., Leipzig, 1948, 855 pp., 67 DM. (*Fernmeldetech. Z.*, July 1949, Vol. 2, No. 7, pp. 225–226.) Excellent both for the student and as a reference book for the engineer. The use of advanced mathematics is avoided throughout. The principal section deals with receiving apparatus, from the aerial to the loudspeaker. Practical design is assisted by the provision of tables, curves and charts and many numerical examples are given.

STATIONS AND COMMUNICATION SYSTEMS

621.395.44 **2905**

A Carrier System for 8 000-c/s Program Transmission.—R. A. Leconte, D. B. Penick, C. W. Schramm & A. J. Wier. (*Bell Syst. tech. J.*, April 1949, Vol. 28, No. 2, pp. 165–180.)

621.395.44 **2906**

Delay Equalization of 8-kc/s Carrier Program Circuits.—C. H. Dagnall & P. W. Rounds. (*Bell Syst. tech. J.*, April 1949, Vol. 28, No. 2, pp. 181–195.) Most of the equalization is effected at a.f., the remainder at carrier frequencies by means of quartz-crystal equalizers. The design of both the a.f. and carrier-frequency equalizers is discussed, with diagrams and photographs of complete units.

621.396.1 : 621.396.931 **2907**

Radio Communications Services: Part 1.—(*FM-TV*, June 1949, Vol. 9, No. 6, pp. 17–19.) A quick-reference guide to the frequency assignments and technical requirements for the various classes of mobile radio service.

621.396.61/.62 : 621.318.572 **2908**

A New Principle for Transceivers.—A. van Weel. (*Philips Res. Rep.*, Oct. 1948, Vol. 3, No. 5, pp. 361–370.) The self-oscillating triode mixing stages discussed in 1174 of April have distinct advantages for transceiver circuits, in particular for synchronized t.r. switching. An ultrasonic frequency can be used for switching, so that two-way communication is possible. A system is described for stabilizing the frequency of both the transmitting oscillator and the local oscillator for reception with the aid of a single cavity resonator.

621.396.619.16 **2909**

Narrow-Band Pulse Transmission.—D. A. Griffin. (*QST*, July 1949, Vol. 33, No. 7, pp. 11–16.) In adapting the pulse technique of radar to communications work, the wide bandwidth necessary for the sharp pulses of radar can be substantially reduced by using comparatively long pulses of sinusoidal shape. The same frequency channel can be used simultaneously for conventional transmissions and for pulse telegraphy, and a number of pulse transmitters can use the same channel if the times of emission of individual pulses are suitably spaced. The special requirements of transmitters and receivers are considered.

621.396.619.16 **2910**

Pulse-Splitting.—A. S. Gladwin. (*Wireless Engr*, June 1949, Vol. 26, No. 309, pp. 210–211.) Indicates the conditions under which splitting occurs in p.m. systems, and their dependence on the amplitude and frequency of the modulating wave.

621.396.65 : 621.396.931 **2911**

The Applications of Radio Links to Railways.—J. Walter. (*Bull. Soc. franç. Élect.*, June 1949, Vol. 9, No. 93, pp. 273–281.) Methods using induction, h.f. guided waves and u.h.f. free waves are considered, with special reference to communication in marshalling yards.

621.396.931 **2912**

Diversity F.M. Transmission.—(*Wireless World*, July 1949, Vol. 55, No. 7, pp. 246–248.) Description of the G.E.C. system comprising a mobile transmitter-receiver, a master transmitter and two unattended satellite broadcasting stations synchronized on a frequency of 97.8 Mc/s. The radio links between the fixed stations operate on frequencies of 146.7, 154 and 155.4 Mc/s.

621.396.931 : 621.396.61/.62 **2913**

Equipment for Remote Pickups.—F. T. Budelman. (*FM-TV*, June 1949, Vol. 9, No. 6, pp. 13–16.) Transmitters and receivers designed for the revised F.C.C. v.h.f. channel assignments, and the new 450–452-Mc/s band.

621.396.931 : 621.396.82 **2914**

Adjacent-Channel Operation of Mobile Equipment.—D. E. Noble. (*Electronics*, June 1949, Vol. 22, No. 6, pp. 90–95.) Receiver r.f. intermodulation is the main problem. By geographical separation of stations operating on adjacent channels, the extreme limits of intermodulation production in the receiver can be reduced to the point where the effects of special receiver design become significant.

621.396.97 **2915**

The War-Time Activities of the Engineering Division of the B.B.C.—H. Bishop. (*Proc. Instn elect. Engrs*, Part III, May 1949, Vol. 96, No. 41, p. 222.) Discussion on 2086 of 1948.

621.396.619.13/.14 **2916**

Advantages and Disadvantages of Frequency and Phase Modulation in the light of the Special Requirements Demanded by Aviation, as well as its Application to Wireless Navigation. [Book Notice]—B.I.O.S. Miscellaneous Report No. 83. H.M. Stationery Office, London, 282 pp., 25s.

SUBSIDIARY APPARATUS

621.314.63 **2917**

On the Boundary-Layer Theory of the Dry Rectifier.—E. Spenke. (*Z. Phys.*, 1949, Vol. 126, Nos. 1/2, pp. 67–83.) Within the framework of the simplified Schottky theory of the boundary layer (2092 of 1942), the concentration distributions of the defect electrons for different loading conditions are calculated. The results are shown graphically. The unipolarity of the boundary layer and the great difference between the resistances in the conducting and blocking directions depend less on the variation of the total thickness of the blocking layer than on the changes of shape of the concentration-distribution curves. The origin of these changes of shape lies in the totally different physical character of the conduction process in the two directions.

621.316.7 **2918**

Rototrol.—J. Hélot. (*Bull. Soc. franç. Élect.*, July 1949, Vol. 9, No. 94, pp. 328–342.) The term 'rototrol' is derived from the two words 'rotor' and 'control'. The main unit of the equipment resembles an ordinary dynamo, from which it differs only in the number of its inductor windings. A detailed description is given of the equipment, with examples of its use for the control of motor speed, voltage etc. See also 1193 of April (Galmiche).

621.396.68 **2919**

Portable High-Voltage Power Supply.—V. Wouk. (*Electronics*, July 1949, Vol. 22, No. 7, pp. 108–112.) Weighs less than 35 lb; uses rectified 60-c/s power; output voltage continuously adjustable from 0 to 30 kV at currents up to 0.5 mA, with reversible polarity and about 5% ripple at full load.

778.3 : 621.3.015.3 **2920**

A New Method for the Photographic Study of Fast Transient Phenomena.—Courtney-Pratt. (*See* 2724.)

621-526 **2921**

Principles of Servomechanisms. [Book Review]—G. S. Brown & D. P. Campbell. Publishers: J. Wiley & Sons, New York, 1948, 400 pp., $5.00. (*Rev. sci. Instrum.*, April 1949, Vol. 20, No. 4, pp. 315–316.) " . . . a correlated work suitable for use as a textbook in engineering schools."

621.314.6 + 621.315.59 **2922**

German Research on Rectifiers and Semi-Conductors. [Book Notice]—B.I.O.S. Final Report No. 725. H.M. Stationery Office, London, 52 pp.

TELEVISION AND PHOTOTELEGRAPHY

621.397.242 : 621.397.6 **2923**

Experimental Transmitting and Receiving Equipment for High-Speed Facsimile Transmission: Part 4 — Transmission of the Signals.—D. Kleis & M. van Tol. (*Philips tech. Rev.*, April 1949, Vol. 10, No. 10, pp. 289–298.) Part 3, 2657 of September (Sloof, van Tol & Unk). Part 5, 2925 below.

621.397.331.2 **2924**

Development and Performance of Television Camera Tubes.—R. B. Janes, R. E. Johnson & R. S. Moore. (*RCA Rev.*, June 1949, Vol. 10, No. 2, pp. 191–223.) A description of three types of image-orthicon tube suitable for various lighting conditions. Construction problems are discussed, and limitations and improvements are mentioned.

621.397.335 **2925**

Experimental Transmitting and Receiving Equipment for High-Speed Facsimile Transmission: Part 5 — Synchronization of Transmitter and Receiver.—D. Kleis & M. van Tol. (*Philips tech. Rev.*, May 1949, Vol. 10, No. 11, pp. 325–333.) Part 4, 2923 above.

621.397.335 **2926**

Transitron Sync Separator.—H. V. Versey. (*Wireless World*, July 1949, Vol. 55, No. 7, pp. 249–250.) A single-valve circuit is described which produces a steep-fronted line-synchronizing pulse at the screen-grid and also a similar frame-synchronizing pulse at the anode. The separation is achieved by choosing a suitable time constant for the combination of a capacitor, connected between the screen and suppressor grids, and a resistor connected between the suppressor grid and cathode.

621.397.6 **2927**

Experimental 729-Line Television Equipment.—J. L. Delvaux. (*Rev. tech. Comp. franç. Thomson-Houston*, May 1949, No. 12, pp. 35–40.) Description and a few technical details of the demonstration equipment noted in 873 of March.

621.397.6 : 621.385.832 **2928**

Picture Storage Tube.—L. Pensak. (*Electronics*, July 1949, Vol. 22, No. 7, pp. 84–88.) For another account see 2061 of July.

621.397.6 : 621.396.67 **2929**

Receiving Aerials for Television.—Roosenstein. (*See* 2718.)

621.397.6 : 621.396.67 **2930**

Indoor Television Aerial.—Best & Duffell. (*See* 2719.)

621.397.6 : 621.396.677 **2931**

Reversible-Beam Antenna for Twelve-Channel Television Reception.—Woodward. (*See* 2720.)

621.397.62 **2932**

Television Receiver, with Miniature Valves, for 450 or 819 Lines.—F. Juster. (*Radio prof., Paris*, March & April 1949, Vol. 18, Nos. 171 & 172, pp. 16–19 & 12–13, 16.) Full circuit details of a receiver using the new American-type valves (see 2079 of July) now made in France. Pentriode mounting is used for the valves in the h.f. video section. The circuits given are applicable to a 450-line system, but the modifications necessary to adapt the receiver to the new 819-line standard are also described.

621.397.62 **2933**

Television Station Selection.—W. T. Cocking. (*Wireless World*, July 1949, Vol. 55, No. 7, pp. 242–246.) Discussion of the general specification of a suitable superheterodyne television receiver for future conditions when 5 stations may be broadcasting the same programme simultaneously.

621.397.62 : 535.88 **2934**

Projection-Television Receiver: Part 4 — The Circuits for Deflecting the Electron Beam.—J. Haantjes & F. Kerkhof. (*Philips tech. Rev.*, April 1949, Vol. 10, No. 10, pp. 307–317.) For previous parts see 1836 of June and back references.

621.397.7 **2935**

WENR-TV.—E. C. Horstman & J. M. Valentine. (*Broadcast News*, April 1949, No. 54, pp. 14–31.) A detailed description of the American Broadcasting Company's Chicago station, including discussion of studio construction and equipment, mobile field equipment, transmitters, and aerial installation on top of the 550-ft Civic Opera Building.

621.397.7 **2936**

WCAU-TV.—J. G. Leitch. (*Broadcast News*, April 1949, No. 54, pp. 52–73.) A fully illustrated description of the television station of WCAU Incorporated, Philadelphia, including discussion of the general arrangement of the various offices and studios, control and transmitting equipment, mobile unit, and 2-section pylon aerial mounted on top of a building nearly 500 ft high.

621.397.823 **2937**

Ignition Interference.—W. Nethercot & S. F. Pearce. (*Wireless Engr*, June 1949, Vol. 26, No. 309, pp. 209–210.) Comment on 2355 of August (Callendar).

621.397.828 **2938**

Minimizing Television Interference.—P. S. Rand. (*Electronics*, June 1949, Vol. 22, No. 6, pp. 70–76.) Types of interference are explained and techniques outlined for improving effective sensitivity and selectivity of receivers.

TRANSMISSION

621.396.61 **2939**

An Experimental Frequency-Modulated Broadcast Transmitter.—J. B. Rudd, W. W. Honnor & W. S. McGuire. (*A.W.A. tech. Rev.*, April 1949, Vol. 8, No. 2, pp. 97–123.) Reprint of 1220 of April.

621.396.61 **2940**

A Criterion for the Stability of the Output Stages of High-Power Radio Transmitters.—G. A. Zeytlenok. (*Radiotekhnika, Moscow*, May/June 1949, Vol. 4, No. 3, pp. 3–20. In Russian.) The stability of the output stages is examined from the standpoint of their self-excitation at the operating frequency. The generation of parasitic oscillations is not considered. Various neutralizing circuits for a push-pull stage are discussed. With any of these circuits the stability of a stage, for a given type of valve and a given operating frequency and capacitance of the neutralized element, depends only on the ratio of the power output of the stage to the power necessary for its excitation. The normal neutralizing circuit is the least stable while the inverse circuit has the highest stability.

621.396.61 : 621.396.662 **2941**

Automatic Tuning of Transmitters.—W. L. Vervest. (*Commun. News*, Jan. 1949, Vol. 10, No. 1, pp. 20–29.) Description of universal click gear which can be used to set a tuning element in any of 11 predetermined positions. A twelfth position is provided for manual tuning. A torque-limiting clutch is included.

621.396.61.029.54 **2942**

New B.B.C. Station at Norwich.—(*R.S.G.B. Bull.*, July 1949, Vol. 25, No. 1, p. 21.) Brief technical details of the 5-kW transmitter operating on 1 013 kc/s which came into service on 19th June 1949.

621.396.615.16 **2943**

Method of Multiple Operation of Transmitter Tubes particularly adapted for Television Transmission in the Ultra-High-Frequency Band.—G. H. Brown, W. C. Morrison, W. L. Behrend & J. G. Reddeck. (*RCA Rev.*, June 1949, Vol. 10, No. 2, pp. 161–172.) For u.h.f. television broadcasting, operation of several transmitter valves into a common load may be required. A bridge circuit is described which enables the total power of two generators to be fed into a single load without interaction, provided that a moderate control of the relative amplitude and phase of their outputs is maintained. Combinations of these 'diplexers' may be built up to increase the number of feed valves. Practical forms of the bridge circuit for various frequency-bands, with means for obtaining wide-band working and balanced-line connections, are given. An experimental 850-Mc/s television transmitter is described and illustrated.

621.396.619.23 **2944**

Some Aspects of the Design of Balanced-Rectifier Modulators for Precision Applications.—D. G. Tucker. **The Effects of an Unwanted Signal mixed with the Carrier Supply of Ring and Cowan Modulators.**—D. G. Tucker. (*Proc. Instn elect. Engrs*, Part III, May 1949, Vol. 96, No. 41, pp. 215–220.) Discussion on 3542 and 3543 of 1948.

VALVES AND THERMIONICS

621.383 **2945**

Multilayer Photocells.—H. Mayer. (*Z. Phys.*, 1948, Vol. 124, Nos. 3/6, pp. 345–347.) Discussion of the possibility of improving the efficiency of photocells by using many layers, of atomic thickness, on thin quartz plates mounted one behind the other, so as to absorb most of the incident light.

621.383 **2946**

Photoelectric Properties of Alkali Layers of Atomic Thickness: Part 3.—H. Mayer. (*Z. Phys.*, 1948, Vol. 124, Nos. 3/6, pp. 326–344.) Measurements of potassium layers vaporized on quartz show that between 2 500 Å and 6 500 Å the photoelectric effect is purely a surface effect. For layers one to two atoms thick the effect is practically equal to that of the massive metal.

621.385 **2947**

Recent Developments in the Technique of Radio Valve Manufacture.—(*Machinery, Lond.*, 23rd June 1949, Vol. 74, No. 1913, pp. 848–852.) Long summary of 2085 of July (Davies, Gardiner & Gomm).

621.385 **2948**

New Types in the Series of Miniature Valves of the Société française Radioélectrique.—(*Ann. Radioélect.*, July 1949, Vol. 4, No. 17, p. 265.) Technical data are given of 5 valves: V2.M70, full-wave rectifier; VM1, h.v. half-wave rectifier; SM.150/30, voltage regulator; PM.04, variable-μ h.f. pentode; TXM.100, tetrode gas-filled thyratron. Corresponding American valves are respectively 6X4, 1654, OA.2, 6BA.6 and 2D.21. The above valves, together with the 7 previously described (2372 of August) fulfil all needs in applications requiring small, robust and reliable valves.

621.385 **2949**

Transconductance as a Criterion of Electron Tube Performance.—T. Slonczewski. (*Bell Syst. tech. J.*, April 1949, Vol. 28, No. 2, pp. 315–328.) Valve performance is usually assessed in terms of the anode-current/grid-voltage characteristic. For many purposes, a simplification results from consideration of the transconductance/grid-voltage characteristic. Formulae are quoted for the pentode amplifier, rectifier, modulator, and frequency doubler; the effects of third-order and fourth-order modulation are considered for single-frequency and 2-frequency inputs.

621.385-71 **2950**

Water-Cooling Versus Air-Cooling for High-Power Valves.—(*Proc. Instn elect. Engrs*, Part III, May 1949, Vol. 96, No. 41, pp. 220–221.) Air cooling appears to be best for low-power mobile equipment, while modern water-cooling systems are probably best for high-power fixed stations. The border line is near 5 kW.

621.385-713 **2951**

Radiators for Transmitting Valves.—A. J. Young. (*Marconi Rev.*, July/Sept. 1949, Vol. 12, No. 94, pp. 85–91.) Factors affecting the design of radiating fins are considered for the case when the cooling air stream is parallel to the axis of the valve.

621.385.002.72 **2952**

The Latest Methods of Cost Reduction applied in a Factory of the Société française Radioélectrique.—L. Thibieroz. (*Ann. Radioélect.*, July 1949, Vol. 4, No. 17, pp. 178–183.) New methods of valve assembly and pumping have resulted in a quality improvement of 15–20% and a cost reduction of 35–40%.

621.385.029.63/.64 **2953**

On the Efficiency of the Travelling-Wave Valve.—O. Doehler & W. Kleen. (*Ann. Radioélect.*, July 1949, Vol. 4, No. 17, pp. 216–221.) Expressions are derived for the electronic efficiency, the circuit efficiency and the overall efficiency. The calculations are based partly on results previously given (250 of January).

621.385.029.63/.64 **2954**

Comparison of the Measured Values for the Linear Gain of the Travelling-Wave Valve with the Values indicated by Various Theories.—L. Brück. (*Ann. Radioélect.*, July 1949, Vol. 4, No. 17, pp. 222–232.) The gain was measured for several valves as a function of the beam current and of the magnetic field used for focusing. The mean helix diameter was from 3.3 mm to 5.5 mm. In some cases the attenuation was distributed along the helix, with values between 30 db and 40 db, but one valve showed a localized attenuation of 50 db. The form of the gain curves is in general agreement with theory, but the theoretical values are much higher than the measured values. The calculated gain varies rapidly with the diameter of the electron beam, but the differences between observed and calculated values are too large to be attributed merely to uncertainty in the knowledge of the beam diameter. It would seem that the value of the coupling resistance in the theory of Doehler & Kleen, and the corresponding value in other theories, ought to be revised.

621.385.032.216 **2955**

The Effect of Gases and Vapours on the Emission of Oxide Cathodes.—G. Herrmann & O. Krieg. (*Ann. Phys., Lpz.*, 25th June 1949, Vol. 4, No. 8, pp. 441–464.) An investigation of the effect of He, Ar, Kr, H, O, CO, CO_2 and some hydrocarbons. Ni cathodes were coated with a mixture of Ba and Sr oxides. Gas pressures ranged from 10^{-5} to 10^{-1} tor and cathode temperatures from 300° to 1 500°K. The observed decreases of emission from cathodes with optimum activation can in all cases be explained by chemical or physical processes. So-called poisoning effects were not observed.

621.385.032.216 **2956**

Contribution to the Study of Oxide Cathodes.—F. Violet & J. Riethmuller. (*Ann. Radioélect.*, July 1949, Vol. 4, No. 17, pp. 184–215.) Methods previously described (1095 of 1948) were applied to investigation of (*a*) the metal support and (*b*) the emissive layer. The effect of impurities in the material of the support, the behaviour of various grades of Ni and the effect of surface contamination were examined; experiments were also carried out with new supports whose composition could be controlled. Results are shown graphically. A secondary standard of emission was established for investigation of the properties of oxide coatings derived from the decomposition of mixtures of carbonates of the alkaline earths. The effects of composition, precipitation conditions and grain size were studied and also the effect of contaminations introduced during the manufacture of the diodes used for the tests. Results are tabulated and discussed.

621.385.032.216 **2957**

Free Barium and the Oxide Cathode.—R. O. Jenkins & R. H. C. Newton. (*J. sci. Instrum.*, May 1949, Vol. 26, No. 5, pp. 172–174.) The greater part of the free barium produced by a modern oxide cathode is formed through chemical reduction by the impurities in the nickel core.

621.385.2 **2958**

The Flicker Effect in Saturated Diodes.—L. de Queiroz Orsini. (*C. R. Acad. Sci., Paris*, 30th May 1949, Vol. 228, No. 22, pp. 1704–1706.) The theory of Macfarlane (4087 of 1947) leads to a formula of the type $i_f^2 = Ci^m/f^n$, where i_f is the current fluctuation due to the flicker effect, i the saturation current, f the frequency at which measurements are made, and $m - n = 1$. Experiments with a 6H6 diode at frequencies from 87 c/s to 4 400 c/s indicate values for m and n of 2.5 and 0.9 respectively, but the dispersion of the experimental results could account for an error of a few tenths in these values. If the saturation current is of the order of 0.1 mA, the formula no longer holds. Macfarlane's theory indicates that the curve for the spectral distribution of frequencies should have a plateau below 400 c/s even for oxide cathodes. This is not confirmed.

To investigate the dependence of the flicker effect on the type of cathode, the mean square of the total current fluctuation was measured for an oxide cathode and for the tungsten filament of a noise diode. On account of the difference in anode current only the general characteristics of the curves can be compared; a decided difference exists.

621.385.2 **2959**

High-Frequency Total-Emission Loading in Diodes.—N. A. Begovich. (*J. appl. Phys.*, May 1949, Vol. 20, No. 5, pp. 457–461.) An expression is derived for the total-emission conductance produced by the electrons returned to the cathode of a diode operating with a retarding off-cathode field. The assumption of a linear potential distribution is justified for the retarding voltage and diode spacing used. Illustrative examples are discussed.

621.385.2 : 621.396.822 **2960**

Retarding-Field Current in a Cylindrical Diode.—D. A. Bell. (*Proc. phys. Soc.*, May 1949, Vol. 62, No. 353B, pp. 334–335.) If a negative potential $-V$ is applied to a plane diode, the current flowing as a result of the initial emission is proportional to $\exp(-eV/k\theta)$, but for a cylindrical diode with thin cathode it is proportional to $\exp(-eV/2k\theta)$. This may explain the difference in noise level between plane and cylindrical diodes. See also 1894 of 1943 and 1829 of 1948 (Weinstein).

621.385.3 **2961**

The Electrostatic Field in Vacuum Tubes with Arbitrarily Spaced Elements.—W. R. Bennett & L. C. Peterson. (*Bell Syst. tech. J.*, April 1949, Vol. 28, No. 2, pp. 303–314.) The derivations of the potential function for the anode/cathode space of a triode are reviewed and expressions are derived for other parameters, neglecting space-charge effects, for the case where the cathode/grid spacing d is less than the spacing a between adjacent grid wires. Curves are given showing amplification factor, cathode field-strength, current density, and transconductance as functions of distance along the cathode for $d/a = 0.4$ to 1.0.

621.385.3 : 621.317.335.2† **2962**

Triode Interelectrode Capacitances.—R. H. Booth. (*Wireless Engr*, June 1949, Vol. 26, No. 309, p. 211.) Comment on 2101 of July (Zepler & Hekner).

621.385.3 : 621.396.822 **2963**

Note on the Reduction of Microphonics in Triodes.—V. W. Cohen & A. Bloom. (*J. appl. Phys.*, Sept. 1947, Vol. 18, No. 9, pp. 847–848.) Comment on 2981 of 1947 (Waynick).

621.385.3.029.64 **2964**

A Microwave Triode for Radio Relay.—J. A. Morton. (*Bell. Lab. Rec.*, May 1949, Vol. 27, No. 5, pp. 166–170.) The close mechanical tolerances are achieved by using a planar electrode system with flat spacing rings. Cathode emission density is very high. The main characteristics of the triode at l.f., as an amplifier and as a modulator are tabulated. Construction and performance are discussed. See also 2390 of August.

621.385.3.032.29 : 621.317.335.2† **2965**

Interelectrode Capacitance of Valves.—(*Radio tech. Dig., Édn franç.*, Feb. 1949, Vol. 3, No. 1, pp. 48–54.) French version of 2102 of July (Humphreys & James).

621.385.38 **2966**

A New Line of Thyratrons.—A. W. Coolidge, Jr. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 723–727. Discussion, pp. 727–728.) Full paper; long summary abstracted in 1834 of June.

621.385.4 **2967**

A New Subminiature Electrometer Tube.—H. F. Starke. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 200–208.) A tetrode, Type CK571AX, with a 10-mA tungsten filament. Microphony noise is about 25 db below that for valves with nickel-alloy filaments. The grid and filament are so close together that the ionization volume is low; grid current is of the order of 2×10^{-15} A.

621.385.5 **2968**

Design Considerations for a Dual Control Grid Pentode.—R. W. Slinkman. (*Proc. nat. Electronics Conference, Chicago*, 1948, Vol. 4, pp. 209–219.) By use of space-charge effects and grid alignments, a No. 3-grid cut-off characteristic is achieved which is equal to or better than the No. 1-grid characteristic for sharpness, yet gives a reasonable ratio of anode to screen current at rated voltage.

621.385.5 : 537.533.8 : 621.396.645 **2969**

Secondary Emission in Output Valves.—J. L. H. Jonker. (*Philips tech. Rev.*, May 1949, Vol. 10, No. 11, pp. 346–351.) Three methods for reduction of secondary emission are discussed. A combination of suppressor grid and coated anode, in output valves, leads to improved characteristics. Output of a battery-driven pentode for 10% distortion is increased from 200 mW to 260 mW by coating the anode with a porous layer of soot.

621.385.832 **2970**

Application of a Variation Method to the Theory of the Electric and Magnetic Deflection of Electron Beams.—Glaser. (*See* 2787.)

621.396.615.141.2 **2971**

On the Dynatron Effect in Multi-Segment Magnetrons.—V. I. Kalinin & G. M. Gerstein. (*C. R. Acad. Sci. U.R.S.S.*, 1946, Vol. 51, No. 4, pp. 275–276. In English.) Secondary emission from the less positive segments is a possible reason for the disappearance of the static falling characteristic in multi-segment magnetrons with oscillations in the circuit connected with the segments.

621.396.615.141.2 **2972**

Multiple Electronic Resonance in Single-Circuit Split-Anode Magnetrons.—H. Ya. Levin. (*Radiotekhnika, Moscow*, May/June 1949, Vol. 4, No. 3, pp. 36–46. In Russian.) The design of a magnetron is considered in which only resonance oscillations are produced. The oscillatory system of such a magnetron should consist of a single tuned circuit with only one fundamental resonance frequency, and the anode segments to which the circuit is connected should be sufficiently narrow to ensure that any possible dynatron effect is negligible. An experimental investigation was carried out with two types of magnetron. One (Fig. 1) had a filament cathode; in the other (Fig. 8) the anode and cathode were made in the form of two coaxial cylinders and the filament (emitter) was mounted in a longitudinal slot in the inner cylinder. The theory of the two magnetrons is discussed and experimental results are given.

621.396.615.141.2 : 537.533.8 **2973**

On the Role of Secondary Emission in the Operation of Split-Anode Magnetrons.—G. M. Gershtein. (*Radiotekhnika, Moscow*, Jan./Feb. 1949, Vol. 4, No. 1, pp. 56–61. In Russian.) Experimental results show that the secondary current from less positive anode segments considerably affects the static characteristics of multi-segment magnetrons, and this current may cause secondary-emission oscillations.

621.396.615.142 **2974**

On the [electron-]**Velocity-Dependent Characteristics of High-Frequency Tubes.**—J. K. Knipp. (*J. appl. Phys.*, May 1949, Vol. 20, No. 5, pp. 425–431.) The electronic transadmittances, transmodulation functions and other characteristics of a planar, multi-grid h.f. valve are expressed in terms of four fundamental admittance and modulation functions, which describe adequately the properties of the electron beam for low modulation levels.

621.396.619.23 **2975**

The Electron Coupler — A Developmental Tube for Amplitude Modulation and Power Control at Ultra-High Frequencies: Part 1 — Physical Theory.—C. L. Cuccia. (*RCA Rev.*, June 1949, Vol. 10, No. 2, pp. 270–303.) 1949 I.R.E. National Convention paper noted in 1824 of June (Cuccia & Donal). A new u.h.f. tube is described, by which control and modulation of power coupled from a generator into a load may be achieved without effect on the generator. A beam of electrons is passed through two resonant cavities in a longitudinal magnetic field. Power injected into the first cavity sets up a transverse electric field. The electrons describe spiral paths of increasing radius until the gap is reached. In the second cavity the radius of the spiral decreases, and power is given up to the output circuit. Modulation is effected by varying the beam current or the electron transit times. Theory of the electron behaviour in the three regions is given, and the limitations on input power, the loading conditions for optimum power transfer and the two methods of modulation are investigated.

621.396.622.6 : 621.396.822 **2976**

Background Noise of Crystal Diodes.—H. F. Mataré. (*Onde élect.*, June 1949, Vol. 29, No. 267, pp. 231–240.) The mechanism of the asymmetric conductivity of semiconductors determines characteristics comparable with those of vacuum diodes with emissive cathodes. From this similarity a law governing the statistical deviations of semiconductors is derived. An equivalent circuit is considered and from its characteristics the mean square of the noise voltage is determined, neglecting the question of the noise temperature of the boundary layer. An analytical expression is introduced which results from comparison between the noise temperature of a diode with emissive cathode and that of the blocking layer of the semiconductor considered. A practical law can then be established for the statistical deviations of crystal diodes. The simplicity of this law permits extension to the dynamic case, starting from the static characteristics of a detector.

621.396.645 **2977**

Amplification by Direct Electronic Interaction in Valves without Circuits.—P. Guénard, R. Berterottière & O. Doehler. (*Ann. Radioélect.*, July 1949, Vol. 4, No. 17, pp. 171–177.) By considering an electron beam as a medium possessing, for small perturbations, a natural frequency, the amplification in a valve with two electron beams of different velocities is simply explained. The theory is extended to the case of larger perturbations and the efficiency to be expected from double-beam valves is estimated. For a difference of velocity corresponding to maximum gain, the efficiency is calculated to be about 14%. See also 1540 of May (Nergaard), 1825 of June (Haeff) and 2486 and 2487 of September (Pierce & Hebenstreit: Hollenberg).

621.396.645 : 537.311.33 : 621.315.59 **2978**

Transistron = Transistor + ?—E. Aisberg. (*Toute la Radio*, July/Aug. 1949, Vol. 16, No. 137, pp. 218–220.) The transistron is the French equivalent of the American transistor and was designed by engineers of the Service des Télécommunications. Secrecy regulations have hitherto prevented the publication of any information regarding the transistron and may have deprived France of priority of invention of this important development.

The transistron is in certain respects superior to its American relative. Its good performance is due principally to the composition of the Ge crystal used, the preparation of which has been supervised by MM. Welcker & Mataré. It consists of a ceramic tube with metal ends, through which the supports for the two fine-wire contacts pass, and a metal attachment at the middle in which the Ge crystal is fixed. The device has already reached the production stage. Photographs are reproduced of various apparatus in which transistrons are incorporated; these include (*a*) a miniature 2-transistron amplifier with components printed on a small plate of plexiglass; (*b*) a similar amplifier inserted in a telephone line; (*c*) a 6-transistron radio receiver; (*d*) a miniature transmitter for $\lambda = 300$ m, of dimensions approximately $10 \times 4 \times 4$ cm; (*e*) a 4-transistron telephony repeater with a gain of 45 db and passband 40–10 000 c/s. One of these repeaters is to be put into service on the Paris/Limoges circuit. Further developments are in progress.

621.396.645 : 537.311.33 : 621.315.59 **2979**

Physical Principles Involved in Transistor Action.—J. Bardeen & W. H. Brattain. (*Bell Syst. tech. J.*, April 1949, Vol. 28, No. 2, pp. 239–276. Bibliography, pp. 276–277.) Historical survey, with discussion of the observed d.c. and a.c. characteristics of triode transistors. Experimental characteristic curves are reproduced. The relationships between emitter and collector currents and potentials are described and the current multiplication-factor (α) is defined. The dependence of α on bias voltage, frequency, temperature and electrode spacing is discussed and illustrated; positive feedback and instability are also considered. Ge point contact rectifiers and the dependence of their performance on temperature and impurities are discussed in terms of the Mott-Schottky theory. Numerical estimates of the factors which determine transistor action are in agreement with practical results. Reprinted in *Phys. Rev.*, 15th April 1949, Vol. 75, No. 8, pp. 1208–1225.

621.396.645.001.4 : 537.311.33 : 621.315.59 **2980**

Testing Transistors.—Lehovec. (*See* 2863.)

621.396.822 **2981**

Are Transit-Angle Functions Fourier Transforms ?—W. E. Benham. (*Wireless Engr*, June 1949, Vol. 26, No. 309, p. 210.) Expresses doubt that the h.f. performance (i.e. transit-angle function) of a thermionic system is determined by the Fourier transform of a purely d.c. property of the system.

621.385 **2982**

R.C.A. Receiving-Tube Manual. Technical Series RC 15. [Book Notice]—Tube Department, Radio Corporation of America, Harrison, N.J., 256 pp., 35 c. Data for the latest receiving valves, including miniature types and kinescopes, and sections dealing with various valve applications, choice of valves for particular services, a.m. and f.m. receiver circuits and a.f. amplifier circuits.

621.385 **2983**

R.C.A. Air-Cooled Transmitting Tubes. Technical Manual TT3. [Book Notice]—Tube Department, Radio Corporation of America, Harrison, N.J., 192 pp., 35 c. In addition to full technical data for a wide variety of valves, useful sections are included on transmitter design, rectifiers and filters. Typical oscillator and amplifier circuits are also given.

621.385 : 621.396.9 **2984**

German Development of Modulator Valves for Radar Applications. [Book Notice]—B.I.O.S. Final Report No. 1746. H.M. Stationery Office, London, 26 pp., 3s.

621.385.032.216 **2985**

Die Oxydkathode [Vol. 1] [Book Review]—G. Herrmann & S. Wagener. J. A. Barth, Leipzig, 1948, 131 pp., 14.40 DM. (*Frequenz*, March 1949, Vol. 3, No. 3, pp. 86–87.) The authors' aim has been to collect the principal results of the extensive literature on oxide cathodes into one book. Vol. 1 deals with physical principles, including thermionic emission of metals, and measurement methods for emissivity, work function, and electrical conduction and diffusion in chemical compounds. Numerous curves and tables are included. Vol. 2 will discuss the technical production and the properties of oxide cathodes.

621.385.832 **2986**

The Krawinkel Image-Storing Cathode-Ray Tube. [Book Notice]—F.I.A.T. Final Report No. 1027. H.M. Stationery Office, London, 19 pp., 4s.

MISCELLANEOUS

621.38/.39 **2987**

Trends in Electronic Engineering.—D. G. Fink. (*Trans. Amer. Inst. elect. Engrs*, 1948, Vol. 67, Part 1, pp. 835–840.) A general survey, covering broadcasting, sound reproduction, pulse-code modulation, navigation aids, heating, machinery control, computers etc.

621.396 **2988**

The Inventor of Radiotelegraphy.—L. Cahen. (*Onde élect.*, March 1949, Vol. 29, No. 264, pp. 137–142.) An examination of this question with particular reference to recent articles in *Wireless Engr* (2429 of 1948) and also to an article by M. Voisenat in *Annales télégraphiques*, March–April 1898.

621.396.6 : 623 **2989**

What should be the Design Considerations of Services' Radio Equipment ?—(*Proc. Instn elect. Engrs*, Part III, May 1949, Vol. 96, No. 41, pp. 252–253.) The needs of the user must be met as far as possible. Ease of operation and of maintenance and fault-finding are important. Rapid mass-production must also be possible in war time. The influence of these factors on design is considered.

621.396.69 : 061.3 **2990**

Strolling at the Paris Fair.—(*Toute la Radio*, July/Aug. 1949, Vol. 16, No. 137, pp. 221–224.) Impressions of the radio novelties, recorded by ' a group of strollers '.

621.396.69 : 061.3 **2991**

Concerning the Paris Fair.—M. Chauvierre. (*Radio franç.*, June 1949, No. 6, pp. 1–6.) A critical review, including discussion of the present situation of television in France.

621.396.69 : 061.3 **2992**

Radio at the 38th Paris Fair.—(*Radio prof., Paris*, June 1949, Vol. 18, No. 174, pp. 17–25.) Illustrated discussion of radio and television receivers, rectifiers, measurement apparatus etc.

669.011.9 **2993**

Research in the Non-Ferrous Field as carried out at the Research Laboratories of the General Electric Company, Limited.—I. Jenkins. (*Metal Treatm.*, Spring 1949, Vol. 16, No. 57, pp. 49–57.) A survey of the activities of the metallurgy group, with particular reference to research on lamp and valve materials, powder metallurgy, process heating etc.

621.396 : 061.3 **2994**

British Commonwealth Specialist Conference on Radio Research. [Book Notice]—H.M. Stationery Office, London, 1949, 4d. (*Govt Publ., Lond.*, May 1949, p. 22.) Report of the proceedings at the conference held in London, August 1948.

ABSTRACTS and REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

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ACOUSTICS AND AUDIO FREQUENCIES

016 : 534 **2995**

References to Contemporary Papers on Acoustics.—A. Taber Jones. (*J. acoust. Soc. Amer.*, July 1949, Vol. 21, No. 4, pp. 440–449.) Continuation of 2683 of October.

534.21 **2996**

On Ray Geometry for Parallel-Layered Media.—W. Gauster-Filek von Wittinghausen. (*Akust. Z.*, Oct. 1943, Vol. 8, No. 5, pp. 175–185.) The geometrical properties of sound-ray curves for a stratified medium with arbitrary velocity distribution are investigated.

534.23 **2997**

Sound Transmission through Multiple Structures containing Flexible Blankets.—L. L. Beranek. (*J. acoust. Soc. Amer.*, July 1949, Vol. 21, No. 4, pp. 419–428.)

534.23 : 620.179.16 **2998**

On Sound Transmission through Metal Plates in Liquids for Oblique Incidence of Plane Waves.—J. Götz. (*Akust. Z.*, Oct. 1943, Vol. 8, No. 5, pp. 145–168.) Theory and experimental results with particular reference to the use of ultrasonic waves at oblique incidence for flaw detection in metal plates.

534.231 **2999**

On the Sound Field of a Piston Membrane.—A. Schoch. (*Akust. Z.*, Nov. 1941, Vol. 6, No. 6, pp. 318–326.) Analysis shows that the sound field of a piston membrane in a rigid wall is made up of two parts: a plane wave, as for the limiting case in geometrical optics, and a diffraction wave from the edge of the membrane. The effect of the diffraction wave vanishes, in general, for infinitely small wavelengths, leaving only the plane wave. For circular membranes, however, singular lines are found along which the effect of the edge wave does not vanish for very small wavelengths.

534.26 **3000**

The Diffraction of Sound by Rigid Disks and Rigid Square Plates.—F. M. Wiener. (*J. acoust. Soc. Amer.*, July 1949, Vol. 21, No. 4, pp. 334–347.) Discussion of experimental technique and comparison of results with theory for various wavelengths and angles of incidence.

534.26 **3001**

Diffraction of Sound by a Circular Disk.—A. Leitner. (*J. acoust. Soc. Amer.*, July 1949, Vol. 21, No. 4, pp. 331–334.) The near and distant diffraction fields of a circular disk of zero thickness are plotted according to an exact theory. The results are compared with the Kirchhoff approximation and recent experimental data.

534.321.9 : 534.22 **3002**

The Velocity of Ultrasonic Waves in an Electric Field and the Effect of Temperature.—A. Bonetti. (*Ricerca sci.*, July 1948, Vol. 18, No. 7, pp. 777–780.) Variation of the velocity of 4.2-Mc/s waves in nitrobenzene with temperature was found in agreement with the theory of polar liquids. No variation due to the application of a field of 7 000 V/cm in the direction of propagation of the ultrasonic beam could be detected.

534.321.9 : 534.232 **3003**

Focusing Ultrasonic Radiators.—G. W. Willard. (*J. acoust. Soc. Amer.*, July 1949, Vol. 21, No. 4, pp. 360–375.) A spherical-shell radiator giving greatly improved energy concentration can be obtained by varying the thickness of the radiator to compensate for radial variations of the frequency constant.

534.321.9 : 534.24 **3004**

Theory of Ultrasonic Intensity Gain due to Concave Reflectors.—V. Griffing & F. E. Fox. (*J. acoust. Soc. Amer.*, July 1949, Vol. 21, No. 4, pp. 348–351.)

534.321.9 : 534.24 **3005**

Experimental Investigation of Ultrasonic Intensity Gain in Water due to Concave Reflectors.—F. E. Fox & V. Griffing. (*J. acoust. Soc. Amer.*, July 1949, Vol. 21, No. 4, pp. 352–359.)

534.321.9 : 679.5 **3006**

Ultrasonic Lenses of Plastic Materials.—D. Sette. (*J. acoust. Soc. Amer.*, July 1949, Vol. 21, No. 4, pp. 375–381.)

534.323 **3007**

On the Subjective Effect of Sound-Spectrum Variations.—E. Löb. (*Akust. Z.*, Sept. 1941, Vol. 6, No. 5, pp. 279–294.) An experimental investigation.

534.612.4 **3008**

The Accuracy of Measurements by Rayleigh Disc.—W. West. (*Proc. phys. Soc.*, 1st July 1949, Vol. 62, No. 355B, pp. 437–444.) A review of proposals for altering König's formula indicates that there is insufficient evidence for changing the numerical constant in the formula. Comparisons between Rayleigh-disk and other methods of microphone calibration are discussed, and the possibility of difference due to reaction of the vibration of the diaphragm on the sound pressure is considered.

534.614 : 533.5 **3009**

On the Velocity of Sound in Air at Low Pressures.—J. Maulard. (*C. R. Acad. Sci., Paris*, 4th July 1949, Vol. 229, No. 1, pp. 25–26.) The results of experiments on transmission through a steel tube (internal diameter 8 cm, length 27.43 m) buried underground, confirm that the velocity shows little change from atmospheric pressure down to 15 cm Hg. Between 15 and 4 cm Hg, however, the velocity increases according to a law sensibly exponential. At 10 cm Hg the increase is about 1.5% and at 4 cm Hg about 4%.

534.75 : 533.723 **3010**

Brownian Movement and Hearing.—H. de Vries. (*Physica, 's Grav.*, Jan. 1948, Vol. 14, No. 1, pp. 48–60. In English.) Results were obtained for the Brownian movement of the ear as a whole, which were compatible with the auditory threshold actually observed. Present theories of the mechanism of hearing do not reconcile the strong thermal agitation of the sense cells with the low audible threshold.

534.78 **3011**

Auditory Masking of Multiple Tones by Random Noise.—T. H. Schaffer & R. S. Gales. (*J. acoust. Soc. Amer.*, July 1949, Vol. 21, No. 4, pp. 392–398.)

534.782 **3012**

Investigations with Artificial Vocal Resonators.—T. v. Tarnóczy. (*Akust. Z.*, Oct. 1943, Vol. 8, No. 5, pp. 169–175.)

534.79 **3013**

The Loudness and Loudness Matching of Short Tones.—W. R. Garner. (*J. acoust. Soc. Amer.*, July 1949, Vol. 21, No. 4, pp. 398–403.)

534.834 **3014**

The Lined Tube as an Element of Acoustic Circuits.—C. T. Molloy. (*J. acoust. Soc. Amer.*, July 1949, Vol. 21, No. 4, pp. 413–418.) A method is given for calculating the performance of acoustic circuits containing long or short lined ducts of diameters less than $\lambda/2$ for sound in free air. Equivalent electrical circuits are discussed. Formulae applicable to filters using lined ducts are listed.

534.84 **3015**

Architectural Acoustics of German Theatres and Concert Halls, Prague.—W. Frank. (*Akust. Z.*, Dec. 1943, Vol. 8, No. 6, pp. 205–208.) Measurements of (*a*) loudness, (*b*) reverberation times under different conditions and for different frequencies, (*c*) relative absorption for different frequencies, are shown graphically.

534.84 **3016**

Variable Room-Acoustics.—K. F. Darmer. (*Akust. Z.*, Nov. 1941, Vol. 6, No. 6, pp. 331–350.) Methods are described for varying the acoustic properties of rooms (theatres, concert halls, etc.) to secure the best results for speech, music, etc.

534.845 **3017**

Sound Absorption by Porous Materials: Part 2.—C. W. Kosten. (*Appl. sci. Res.*, 1949, Vol. B1, No. 4, pp. 241–250.) The case of narrow tubes is considered, in which the flow is essentially of the Poiseuille type. A correction to the velocity of sound analogous to that of Kirchhoff for wide tubes is obtained. The correction is not important for the damping or the sound velocity, but it may greatly affect the absorption coefficients of porous materials. See also 2144 of 1948 (v.d. Eijk, Kosten & Kok).

534.845 : 666.3 **3018**

On the Air-Flow Resistance of Porous Ceramic Materials.—H. F. Gerdien. (*Akust. Z.*, Nov. 1941, Vol. 6, No. 6, pp. 329–331.) The sound absorbing power of a porous material can be found from knowledge of its thickness, porosity and air-flow resistance. Measurements of the resistance for 13 ceramic filters and 8 of Jena glass show that the resistance is related to the diameter and length of the pores in a material by a law of the Hagen-Poiseuille type.

534.861 : 785.1 **3019**

The Broadcasting of Orchestras.—F. W. Alexander. (*B.B.C. Quart.*, July 1949, Vol. 4, No. 2, pp. 118–128.) Discussion of microphone placing, acoustic properties of concert halls, tone balance, loudness, use of echo room, etc.

621.3.012.8 : 621.395.623.45 **3020**

Equivalent Electrical Circuit for the Piezoelectric Sound-Receiver.—O. Schäfer. (*Akust. Z.*, Nov. 1941, Vol. 6, No. 6, pp. 326–328.)

621.392.51 **3021**

Piezoelectric Transducers.—W. Roth. (*Proc. Inst. Radio Engrs, W. & E.*, July 1949, Vol. 37, No. 7, pp. 750–758.) A piezoelectric transducer operating in the thickness mode is represented as a six-terminal network. The mesh equations, electromechanical impedance matrix, and equivalent circuit valid for any general conditions of loading and frequency are obtained. Equations for the electrical driving-point impedance are derived.

621.395.61/.62 **3022**

A Low-"*Q*" Directional Magnetostrictive Electro-acoustic Transducer.—L. Camp & F. D. Wertz. (*J. acoust. Soc. Amer.*, July 1949, Vol. 21, No. 4, pp. 382–384.) Description of a lamination design for the magnetostrictive motors of a directional transducer array. Efficient operation is possible with a Q of 6 under a full water load.

621.395.61 **3023**

A New Dynamic Microphone.—W. Baer. (*Akust. Z.*, Aug. 1943, Vol. 8, No. 4, pp. 127–135.) Theory is based on the equivalent circuit. Details of the construction of the Beyer moving-coil microphone are given.

621.395.61 **3024**

The B.B.C.-Marconi Ribbon Microphone Type AXBT.—E. T. Wrathall. (*Marconi Rev.*, July/Sept. 1949, Vol. 12, No. 94, pp. 92–103.) Designed in 1933 by the research department of the B.B.C. for studio use. The microphone consists of a crimped Al-foil ribbon supported between specially shaped pole-pieces of a powerful Alcomax permanent magnet. The ribbon resonates at a sub-audio frequency; the amplitude of its motion is proportional to the particle velocity of the incident sound wave. The horizontal and vertical polar curves of sensitivity have the figure-of-eight shape. The ribbon is electrically screened and is protected from draughts and dust. Maintenance requirements are negligible over long periods.

621.395.61 : 621.396.822 **3025**

The Noise Level of High-Grade Microphones.—W. Weber. (*Akust. Z.*, Aug. 1943, Vol. 8, No. 4, pp. 121–127.) The noise levels of microphones of the dynamic and capacitive types, made by several well-known firms, were calculated and determined experimentally. For the dynamic microphones the thermal noise of the internal resistance is about 10 times that of the first valve of the amplifier. The capacitor microphone itself produces no noise, but noise voltages are introduced by the load resistance in the low-frequency arrangement and by the resonance resistance of the oscillatory circuit in the high-frequency arrangement. The noise level in the low-frequency arrangement is again higher than that of the first amplifier valve, at the lower and middle frequencies by about 10 db, falling at the higher frequencies to about that of the valve. With suitable design of the high-frequency arrangement the noise level can be reduced by about 10 db.

621.395.623.7 : 791.45 **3026**

Theater Loudspeaker Design, Performance, and Measurement.—J. K. Hilliard. (*J. Soc. Mot. Pict. Engrs*, June 1949, Vol. 52, No. 6, pp. 629–640.)

621.395.623.7.089.6 **3027**

Physical Measurements of Loudspeaker Performance.—Veneklasen. (*See* 3207.)

621.395.625.2 : 621.392.52 **3028**

Crossover Filter for Disk Recording Heads.—Roys. (*See* 3085.)

621.395.625.3 **3029**

Tape Characteristics for Audio Quality.—R. Marchant. (*Tele-Tech*, July 1949, Vol. 8, No. 7, pp. 30–33 . . 57.) A general survey covering the electrical and mechanical properties of the tape, mechanical requirements of the driving and tension devices and the playback head, the effect of the mains supply voltage on the tape velocity and precautions to avoid deterioration of the tape in storage.

621.395.625.3 **3030**

Factors affecting Spurious Printing in Magnetic Tapes.—S. W. Johnson. (*J. Soc. Mot. Pict. Engrs*, June 1949, Vol. 52, No. 6, pp. 619–627. Discussion, pp. 627–628.) Study of the amount of signal printed through from adjacent layers in a roll of magnetic tape. The effects of time, temperature and output level of the original recording are considered.

621.395.625.3 **3031**

Optimum High-Frequency Bias in Magnetic Recording.—G. L. Dimmick & S. W. Johnson. (*Broadcast News*, June 1949, No. 55, pp. 4–7.)

534.321.9 : 620.179.16 **3032**

Ultrasonics. [Book Review]—B. Carlin. Publishers: McGraw-Hill Book Co., New York, 1949, 270 pp., $5.00. (*Electronics*, Aug. 1949, Vol. 22, No. 8, pp. 209–210.) For readers with an engineering viewpoint. Piezoelectric and magnetostriction generators are considered, as well as c.w. and pulsed systems. The use of ultrasonics for flaw detection is the application most thoroughly covered.

AERIALS AND TRANSMISSION LINES

621.315.1 : 531.221.8 **3033**

Graphical Calculation of Tension Tables for Overhead Lines and Horizontal Copper-Wire Aerials.—C. M. A. Carranza. (*Rev. Telecomunicación, Madrid*, June 1948, Vol. 3, No. 12, pp. 16–23.) Abacs for determining tension, sag and safety factor as a function of temperature for various lengths of span and diameters of wire.

621.315.212 : 621.3.09 **3034**

Coaxial Cables.—P. Schiaffino & L. Albanese. (*Poste e Telecomunicazioni*, Feb. 1949, Vol. 17, No. 2, pp. 85–104.) A study of propagation phenomena, particularly those affecting telephony, transmission characteristics, existing types of coaxial cable and the problems associated with laying and joining such cables, fault clearance and the S.A.C.M. echo meter noted in 142 of January (Couanault & Herreng).

621.392.26† **3035**

Waveguides.—R. Malvano. (*Ricerca sci.*, Nov./Dec. 1948, Vol. 18, Nos. 11/12, pp. 1595–1612.) Transmission theory with special reference to waveguides with dielectric inserts.

621.392.26† **3036**

On the Theory of the Excitation of Radio Wave Guides.—G. V. Kisunko. (*C. R. Acad. Sci. U.R.S.S.*, 30th Jan. 1946, Vol. 51, No. 3, pp. 199–202. In English.) Formulae are derived for the field due to conductors with arbitrary current distribution and of arbitrary configuration within the waveguide.

621.392.26† **3037**

Reflection Cancellation in Waveguides.—L. Lewin. (*Wireless Engr*, Aug. 1949, Vol. 26, No. 311, pp. 258–264.) A tapered section with uniform variation is commonly used to provide a smooth transition between waveguides of different cross-sections. For freedom from reflections, the length l of the tapered section should be as great as possible, and must exceed $\lambda/2$. Minima of total reflection occur when $l = n\lambda/2$, and maxima when $l = (2n + 1)\lambda/4$, n being an integer. The case of small-angle tapers is discussed, with special reference to the diaphragm method of reflection compensation. The field-fitting method yields results which can be generalized and are applied to the general double taper.

621.392.26† **3038**

Experimental Investigation of the Reflections produced in a Waveguide by any Dielectric.—L. R. Noriega. (*Rev. Telecomunicación, Madrid*, June 1948, Vol. 3, No. 12, pp. 2–10.) Verification of theory developed by L. W. Holmboe in a thesis entitled "Reflections produced at the Junction of Two Rectangular Waveguides, one filled with a Single Dielectric and the other with Two Dielectrics."

621.392.26† **3039**

Notes on the Excitation of Electromagnetic Waves in Cylindrical Metal Waveguides.—A. Colino. (*J. appl. Phys.*, June 1949, Vol. 20, No. 6, pp. 576–577.) Starting from Maxwell's equations, general formulae applicable to cylindrical waveguides of any cross-section are derived. These formulae are of simple structure and for the case of a waveguide of circular cross-section excited by an aerial on the axis result in a formula identical with one given by Schelkunoff. For the original version (in Spanish) see *Rev. Telecomunicación, Madrid*, June 1948, Vol. 3, No. 12, pp. 34–37.

621.392.26†: 621.396.611.4 **3040**

The Analogies between the Vibrations of Elastic Membranes and the Electromagnetic Fields in Guides and Cavities.—E. C. Cherry. (*Proc. Instn elect. Engrs*, Part III, July 1949, Vol. 96, No. 42, pp. 346–358. Discussion, pp. 358–360.) Detailed relations are shown between the fields in guides and cavities, and the vibrations of elastic sheets having similar boundaries. Only one of the two sets of electromechanical analogies commonly applied to circuits such as transmission lines and filters is applicable to distributed systems. In this, velocity corresponds to voltage (or E-vector) and force to current (or magnetic H-vector). Mass corresponds to capacitance (or κ) and elastic constant to inverse inductance (or $1/\mu$). A study of membrane vibrations may assist in the design of microwave components and in the derivation of new selective network forms.

621.392.26† : 621.396.67 **3041**

Electromagnetic Radiation from Waveguides and Horns.—L. Lewin. (*Nature, Lond.*, 20th Aug. 1949, Vol. 164, No. 4164, p. 311.) The method of Levine and Schwinger (1845 of 1948) for analysing the acoustic radiation from circular pipes is applied to the case of e.m. radiation from rectangular waveguides.

621.392.26† : 621.396.67 **3042**

The Electromagnetic Horn : Parts 1 & 2.—W. D. Oliphant. (*Electronic Engng*, July & Aug. 1949, Vol. 21, Nos. 257 & 258, pp. 255–258 & 294–299.) A survey paper, in which much of the information is abstracted from the 16 references given. Basic theory, design principles, and experimental results are discussed, with special reference to rectangular waveguides and the sectoral horn.

621.392.26† : 621.396.67 **3043**

Transmission-Line Characteristics of the Sectoral Horn.—H. S. Bennett. (*Proc. Inst. Radio Engrs, W. & E.*, July 1949, Vol. 37, No. 7, pp. 738–743.) The sectoral horn is considered as one component of a microwave transmission system. Equivalent network functions are derived and plotted, the sectoral horn being regarded as a non-uniform transmission line. The physical significance of the derived normalized functions is discussed.

621.392.26† : 621.396.67 **3044**

Laws of Potential Distribution along Slits [slots].—J. N. Feld. (*C. R. Acad. Sci. U.R.S.S.*, 20th Feb. 1947, Vol. 55, No. 5, pp. 407–410. In English.) Approximate formulae, applicable to narrow radiating slots in waveguides, are derived.

621.392.43.012.3 **3045**

High-Frequency Transmission Line Chart.—P. R. Clement. (*Electronics*, Aug. 1949, Vol. 22, No. 8, pp. 104–105.) Determination of input impedances and matching-stub dimensions is simplified by means of a chart in which straight lines are used instead of curves as in circle or Smith diagrams.

621.396.67 **3046**

The Measurement and Interpretation of Antenna Scattering.—D. D. King. (*Proc. Inst. Radio Engrs, W. & E.*, July 1949, Vol. 37, No. 7, pp. 770–777.) The significance of scattering and back-scattering cross-sections in terms of aerial current distribution is considered, with particular reference to the influence of aerial load impedance on the magnitude and directional pattern of the scattered radiation. A method of measurement, which uses the standing waves set up by energy reflected toward the transmitter from any receiving aerial or parasite, permits direct study of the back-scattering from loaded and unloaded aerials. Approximate scattering data for several types of aerial are included.

621.396.67 **3047**

Experimental Determination of the Distribution of Current and Charge along Cylindrical Antennas.—G. Barzilai. (*Proc. Inst. Radio Engrs, W. & E.*, July 1949, Vol. 37, No. 7, pp. 825–829.) Using a wavelength of 1.90 m, the distributions are determined for centre-fed straight cylindrical aerials of diameter 29 mm and lengths 1.25 λ, 1.00 λ, and 0.50 λ respectively. In some cases parasitic aerials were added. The experimental accuracy was checked by means of measurements on a coaxial line whose inner conductor had the same diameter as the aerials.

621.396.67 **3048**

Radiating Surface Systems.—J. N. Feld. (*C. R. Acad. Sci. U.R.S.S.*, 30th Jan. 1946, Vol. 51, No. 3, pp. 203–206. In English.) A closed metal surface of dimensions comparable with the wavelength can in certain cases, if suitably excited, compare favourably with ordinary radiating systems. Formulae are derived for the e.m. field and the surface distribution of current for a spherical-surface aerial excited by a known current distribution along a radial conductor inside the surface. The method adopted for the solution can easily be generalized for surface aerials of arbitrary form with an arbitrary arrangement of coupling elements.

621.396.67 **3049**

Diffraction Antennae with Axial Symmetry.—J. N. Feld. (*C. R. Acad. Sci. U.R.S.S.*, 20th Jan. 1946, Vol. 51, No. 2, pp. 155–118. In English.) The aerials considered are obtained by cutting the surface of endovibrators. Formulae are derived and applied to the determination of the field inside and outside a sphere from which a narrow belt has been cut out, the excitation being due to a dipole at the centre.

621.396.67 **3050**

Excitation of a Hollow Spherical Resonator by a Dipole placed at its Centre.—S. M. Rytov. (*C. R. Acad. Sci. U.R.S.S.*, 20th Jan. 1946, Vol. 51, No. 2, pp. 111–114. In English.) Formulae are derived for the field within the resonator and for the energy dissipation. A small hole on the equator of the sphere radiates like a magnetic dipole parallel to the equator.

621.396.67 **3051**

Discone — 40 to 500 Mc/s Skywire.—J. M. Boyer. (*CQ*, July 1949, Vol. 5, No. 7, pp. 11–15..71.) The evolution of the discone from a flared open-ended waveguide is traced. Dimensions and construction details are given of three models whose frequency ranges are respectively 40–500 Mc/s, 400–1 200 Mc/s and 800–5 000 Mc/s. The last provides a means of measuring the radiation pattern of the discone by the model technique. See also 303 of February (Kandoian, Sichak & Felsenheld).

621.396.67.016.31 **3052**

A Power-Equalizing Network for Antennas.—R. W. Masters. (*Proc. Inst. Radio Engrs, W. & E.*, July 1949, Vol. 37, No. 7, pp. 735–738.) A bridge type of network which causes equal power to be delivered to two load impedances whose product is a predetermined real constant. The input impedance of the bridge is practically independent of suitably paired load-impedance values over a considerable band of frequencies. Application to the design of television broadcast aerials is indicated, examples are given, and power loss is discussed.

621.396.671 **3053**

On the Theory of the Radiation Patterns of Electromagnetic Horns of Moderate Flare Angles.—C. W. Horton. (*Proc. Inst. Radio Engrs, W. & E.*, July 1949, Vol. 37, No. 7, pp. 744–749.) A method attributed to Schelkunoff for the computation of radiation patterns is considered. For the case of transverse electric waves in a waveguide or horn of moderate flare angle, the radiation pattern is calculated in terms of two definite integrals. These integrals are evaluated for rectangular, circular, and semicircular horns for some common modes of vibration. Experimental results are in agreement with theory.

621.396.671 **3054**

The Radiation Resistance of Linear Aerials.—A. A. Samarski & A. N. Tikhonov. (*Zh. tekh. Fiz.*, July 1949, Vol. 19, No. 7, pp. 792–803. In Russian.) The reactive component of the radiation resistance is calculated for a given current distribution. This component remains finite only in the case of a tuned dipole.

621.396.671 **3055**

The Transmitter Dipole.—J. Müller-Strobel & J. Patry. (*Schweiz. Arch. angew. Wiss. Tech.*, Oct. 1948, Vol. 14, No. 10, pp. 306–314.) Theory previously given (1334 of 1947) is applied to the calculation of the radiation impedance of vertical wire aerials with and without resistance losses. A practical formula is derived and its accuracy checked by measurements on a balloon-supported aerial. The discrepancies between theory and experiment can be easily explained. The problem of aerial resonance can be solved by means of the accurate formula, but in most cases a simple relation can be used.

621.396.671 **3056**

Evaluation of the Gain of a Microwave Radiating System.—F. Bosinelli. (*Ricerca sci.*, Aug./Sept. 1948, Vol. 18, Nos. 8/9, pp. 1009–1015.) For an aerial with a parabolic reflector the gain G is given approximately by the formula $G = 4\pi I_1{}^2/\lambda^2 I_2$, where I_1 and I_2 are integrals involving the field distribution over the aperture of the reflector. Particular distributions are considered and a curve is given showing the diminution in gain for parabolic distributions more or less accentuated.

621.396.671 **3057**

Gain of Aerial Systems.—D. A. Bell. (*Wireless Engr*, Sept. 1949, Vol. 26, No. 312, pp. 306–312.) The maximum gain of an aerial of given aperture depends on the phase distribution of the illumination of the aperture. Three cases are considered, in order of increasing gain: (*a*) uniform-phase radiators (broadside arrays and 'optical' radiators), (*b*) radiators with effective phase-shift of π (end-fire aerials of all kinds), (*c*) aerials with closely-spaced phase reversals (high-gain short aerials). See also 302 of January (Woodward & Lawson).

621.396.677 **3058**

Path-Length Microwave Lenses.—W. E. Kock. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1949, Vol. 37, No. 8, pp. 852–855.) Baffle plates extend parallel to the magnetic vector, and are suitably tilted or bent to force the waves to follow a longer path. The plate array is shaped to correspond to a convex lens. Advantages over other types of metallic lens are: broader-band performance, greater simplicity, and less severe tolerances. See also 2176 of 1948.

621.396.677 : 621.396.93 **3059**

Direction-Finding Site Errors at Very High Frequencies.—Hopkins & Horner. (*See* 3145.)

CIRCUITS AND CIRCUIT ELEMENTS

621.3.011.2 **3060**

Impedance of Composite Conductors.—A. Rosen. (*Wireless Engr*, Aug. 1949, Vol. 26, No. 311, pp. 267–275.) Schelkunoff's theorem for calculating this impedance (435 of 1935) is developed to derive useful working formulae. The theorem can be deduced by an extension of a method devised by Howe. Simplifications of the formulae have been made in the case of coaxial tubular conductors, where the radii of the conductors are electrically large and the curvature may be neglected.

621.3.016.35 **3061**

A New Harmonic Method for Studying the Stability of Linear Systems.—Demontvignier & Lefèvre. (*See* 3127.)

621.3.087.4 : 551.510.535 **3062**

New Equipment for the Systematic Recording of Ionospheric Echoes.—A. Bolle. (*Ann. Geofis.*, April 1948, Vol. 1, No. 2, pp. 164–174.) Circuit details and description of apparatus with which the band 2.5–20 Mc/s is swept at 3-minute intervals. As in the equipment described by Sulzer (2983 of 1946) the v.f.o. controls both the frequency of the transmitter and that of the heterodyne stage of the receiver, the frequency being varied periodically by means of an electric motor driving gearing attached to a variable capacitor. Peak pulse power is about 20 kW at the lower frequencies.

621.314.2 : 621.396.611.33/.34 **3063**

A Design for Double-Tuned Transformers.—J. B. Rudd. (*J. Brit. Instn Radio Engrs*, Aug. 1949, Vol. 9, No. 8, pp. 306–316.) The term 'transformer' is used in the broad sense to include networks consisting of a pair of LC circuits with either inductive or capacitive coupling. A method is described of designing such transformers to provide uniform power transmission over a given frequency range; the insertion-loss curve is then approximately symmetrical when plotted on a linear frequency scale. The frequency variable used in the design equations allows a common representation of both inductively and capacitively coupled transformers. The extent of the uniform-transmission band and the transformation ratios possible with various types of coupling are discussed. Charts are presented which simplify the design procedure. Practical circuits satisfying specified conditions are given. See also 2177 of 1948 (Rideout). Reprinted from *Proc. Instn Radio Engrs, Aust.*, Jan. 1949, Vol. 10, No. 1.

621.314.3† **3064**

An Analysis of Magnetic Amplifiers with Feedback.—D. W. ver Planck, M. Fishman & D. C. Beaumariage. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1947, Vol. 37, No. 8, pp. 862–866.) Full paper; summary noted in 2448 of September.

621.314.3† **3065**

The Transductor, D.C. Pre-Saturated Reactor, with special reference to Transductor Control of Rectifiers.—U. Lamm. (*Acta polyt., Stockholm*, 1948, No. 17, 215 pp. In English.) Fundamental principles are outlined and various methods of using transductors for regulation and control purposes are described. Similarity laws for the practical design of a series of transductors from measured values for one unit of the series are derived. A theory of transductor-controlled multi-phase rectifiers is developed. Static and dynamic conditions are treated and general equations for rapid calculation of transductor-regulator parameters are derived. Experimental results confirm the theory.

621.316.313 **3066**

Electrical Network Analyzers for the Solution of Electromagnetic Field Problems: Parts 1 & 2.—K. Spangenberg, G. Walters & F. Schott. (*Proc. Inst. Radio Engrs, W. & E.*, July & Aug. 1949, Vol. 37, Nos. 7 & 8, pp. 724–729 & 866–872.) 1948 I.R.E. Convention paper noted in 2475 of 1948. Discussion of the design and construction of two analysers for solving the wave equation in two-dimensional axially-symmetric cylindrical coordinates and in rectangular coordinates. The use of these analysers is also considered for determining various modes of concentric lines, waveguides and resonators, field-strength distributions, resonant frequencies of cavities, etc.

621.316.8 : 621.396.822 **3067**

Noise from Current-Carrying Resistors 20 to 500 kc/s.—R. H. Campbell, Jr, & R. A. Chipman. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1949, Vol. 37, No. 8, pp.

938–942.) The d.c. noise voltage for some resistors has fluctuations much larger than those characteristic of thermal noise. This effect was investigated experimentally for solid carbon-composition, metallized palladium film, and pyrolitic-carbon resistors, for resistances from 1 to 30 kΩ and currents from 1 to 10 mA. The fluctuations are large when current is first applied to a resistor, before its resistance reaches an equilibrium value at a higher temperature. The effect is thus analogous to the Barkhausen magnetization effect, but cannot as yet be correlated with other factors.

621.316.86 **3068**

Thermistors.—G. Pierry. (*Toute la Radio*, Sept. 1949, Vol. 16, No. 138, pp. 240–242.) A short account of different types, their properties and uses.

621.317.35 **3069**

On Some Properties of Signals with Limited Spectra.—J. Oswald. (*C. R. Acad. Sci., Paris*, 4th July 1949, Vol. 229, No. 1, pp. 21–22.) Every signal function $x(t)$ whose corresponding Fourier function $X(f)$ is zero outside a finite interval $(-f_1, f_1)$ can be developed in a series of orthogonal functions. The equidistant ordinates x_n completely determine such a signal; they are the components of a vector of the Hilbert sub-space defined by the segment $(-f_1, f_1)$ in the space (f) derived from the space (t) by the Fourier unitary transformation. All the parameters of the signal $x(t)$ can be expressed in terms of the coefficients x_n and all the transformations of $x(t)$ by linear operators can be studied equally well by means of these coefficients. Examples are given.

621.318.572 **3070**

New Design for a Secondary-Emission Trigger Tube.—C. F. Miller & W. S. McLean. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1949, Vol. 37, No. 8, pp. 952–954.) 1948 I.R.E. National Convention Paper. A triode input section produces a primary electron beam which impinges on a dynode to produce secondary electrons. These are collected by two different output elements which may be used separately or as a unit. A dynode surface having long life and stability is described. Suggested applications include its use as a relaxation oscillator, multivibrator, pulse inverter, triangular-wave generator, and dynatron. See also 1567 of 1943 (Skellett).

621.318.572 **3071**

Admittance of the 1B25 Microwave Switching Tube.—R. W. Engstrom & A. R. Moore. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1949, Vol. 37, No. 8, pp. 879–881.)

621.319.4 : 621.315.614 **3072**

Paper Capacitors using Chlorinated Liquid Impregnants.—C. G. Farley. (*Proc. Instn Radio Engrs, Aust.*, July 1948, Vol. 9, No. 7, pp. 13–17. Discussion, pp. 17–18.) Trends in the development and use of synthetic impregnants are discussed, the characteristics of chlorinated naphthalene, chlorinated diphenyl and natural impregnating compounds such as castor oil are compared, and the physical and electrical properties of capacitors impregnated with pentachlorodiphenyl are tabulated and discussed.

621.392 **3073**

Bridged Reactance-Resistance Networks.—G. R. Harris. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1949, Vol. 37, No. 8, pp. 882–887.) 6-arm, 6-element RC bridged networks are considered. Six symmetrical structures exist having the infinite attenuation property of the parallel-T network. The duality of certain pairs of these structures is demonstrated.

621.392 **3074**

Effective and Circuit Band-Widths.—W. J. Kessler. (*Elect. Engng, N.Y.*, July 1949, Vol. 68, No. 7, p. 590.) Summary only. The effective bandwidth of any network of maximum response A is defined as the bandwidth of an equivalent network whose response is A throughout the transmission band, provided the noise powers developed across the output terminals of the two networks are equal for the same noise-signal input. The term 'circuit bandwidth' is reserved to specify the selectivity or frequency-discriminating properties of a network. The effective bandwidth is equal to the area under the squared response curve divided by the square of the maximum response. For a single elementary LC network the ratio of effective to circuit bandwidth (3-db attenuation) is equal to $\pi/2$. This ratio approaches 1.07 as the number of such elementary circuits in cascade increases and approaches unity as the response curve approaches a rectangular form.

621.392 **3075**

The Gyrator, a New Circuit Element.—H. Feigs. (*Funk u. Ton*, Aug. 1949, Vol. 3, No. 8, pp. 459–465.) A shortened version of Tellegen's recent work (980 of April and 2745 of October).

621.392 **3076**

Miller Effect.—"Cathode Ray". (*Wireless World*, Aug. 1949, Vol. 55, No. 8, pp. 307–312.) A step-by-step resolution of some of its paradoxes for resistive and for reactive loads.

621.392 : 517.433 **3077**

Operational Approach to Nonlinear Circuit Analysis.—G. H. Cohen. (*J. Franklin Inst.*, June 1949, Vol. 247, No. 6, pp. 573–581.) The operational method can be extended to nonlinear-circuit problems by first expanding the expression for the unknown variable i in a power series of the driving function e. Each term of the series represents a component of the total current. Each component is an operational expression for a linear differential equation involving the current component i_r to the first power, the impedance C_r corresponding to this current component, and the rth power of the driving voltage. The nonlinearity is thus shifted from the unknown dependent variable i to the known independent variable e, making it possible to find and solve the transformed equations for each current component.

621.392.4 **3078**

Constant-Phase-Shift Networks.—R. O. Rowlands. (*Wireless Engr*, Sept. 1949, Vol. 26, No. 312, pp. 283–287.) To every phase-shift network there corresponds an attenuation network whose attenuation is directly related to the phase shift of the first network. This attenuation network, being easier to design, is designed first, and from its parameters those of the phase-shift network are deduced.

621.392.4 : 621.3.015.3 **3079**

The Energy of a Passive Linear Two-Terminal Network in the Transient Regime.—M. Abele. (*R. C. Accad. naz. Lincei*, Dec. 1946, Series 8, Vol. 1, No. 12, pp. 1321–1324. In Italian. Reprint.) General treatment for the case where the applied e.m.f. is a periodic function of time. This is extended to the case of a non-periodic e.m.f. of short duration, by considering it as a single period of a periodic e.m.f.

621.392.43 **3080**

Compact Antenna-Coupling Device.—S. Wald. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, March 1949, Vol. 12, No. 3, pp. 7, 30.) Description, with illustrations, of a continuously variable inductor with two independent tappings which can be used for aerial tuning and matching over a wide frequency range.

621.392.5 : 621.3.015.3 **3081**

Transients in the Low-Pass Filter.—G. Newstead & D. L. H. Gibbings. (*Proc. Instn elect. Engrs*, Part III, July 1949, Vol. 96, No. 42, pp. 264–268.) Formulae for the termination current are given and plotted for various impulsive voltage inputs. Limitations of the usual approximate treatments are discussed. A solution is obtained for a uniformly dissipative low-pass filter terminated in a resistance of $\sqrt{(L/C)}$.

621.392.5 : 681.142 **3082**

Mercury Delay Line Memory using a Pulse Rate of Several Megacycles [per second].—I. L. Auerbach, J. P. Eckert, Jr, R. F. Shaw & C. B. Sheppard. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1949, Vol. 37, No. 8, pp. 855–861.) The possible pulse rate has been effectively doubled by means of the pulse envelope system of representing data. The control of signals at high pulse rates has been achieved by means of crystal gating circuits. A multichannel memory using a single pool of mercury has simplified mechanical construction and temperature control, and has reduced the size. Intelligence can be transmitted and received by the memory system described at 5×10^6 binary digits per second.

621.392.52 **3083**

A Valve-Assisted Filter for Audio Frequencies.—J. D. Storer. (*J. Brit. Instn Radio Engrs*, July 1949, Vol. 9, No. 7, pp. 268–275.) The filter combines the function of voltage limiting and wave filtering, and consists of a flip-flop oscillator which is inoperative until triggered. Its oscillation frequency is controlled by that of the triggering voltage, which is developed across a reactive circuit. Characteristics are summarized and circuit diagrams illustrating the applications of the filter are given.

621.392.52 **3084**

RC Filter Networks.—A. Sabbatini. (*Poste e Telecomunicazioni*, March 1948, Vol. 16, No. 3, pp. 83–88.) Detailed analysis of (*a*) a bridge-type circuit for phase variation due to Scott (1802 of 1938), (*b*) a resonance potential divider due to Willoner & Tihelka (*Hochfrequenztech. u. Elektroakust.*, Feb. 1944, Vol. 61, No. 2, p. 48), (*c*) a RC amplification stage, (*d*) RC low-pass and high-pass filters.

621.392.52 : 621.395.625.2 **3085**

Crossover Filter for Disk Recording Heads.—H. E. Roys. (*Broadcast News*, June 1949, No. 55, pp. 20–23.)

621.395.665.1 **3086**

Contrast Expansion.—G. Mitchell : J. G. White. (*Wireless World*, Aug. 1949, Vol. 55, No. 8, pp. 315–316.) Comment on 2171 of August (Wheeler).

621.396.611.1 **3087**

Iterative Impedance and Resonance Curve of Symmetrical Homogeneous Recurrent Circuit.—P. Kalantarov & L. Zeitlin. (*C. R. Acad. Sci. U.R.S.S.*, 10th Feb. 1946, Vol. 51, No. 4, pp. 281–284. In English.)

621.396.611.1 **3088**

On Approximate Integration for Oscillatory Systems with One Degree of Freedom.—V. V. Kazakevitch. (*C. R. Acad. Sci. U.R.S.S.*, 20th Jan. 1946, Vol. 51, No. 2, pp. 107–110. In French.) A method enabling the building-up process, the form and the period of the oscillations of a system to be determined for the case where there are no external perturbations.

621.396.611.1 **3089**

Resonance Phenomena in Homogeneous Symmetrical Recurrent Circuits.—P. L. Kalantarov & L. A. Zeitlin. (*C. R. Acad. Sci. U.R.S.S.*, 20th Feb. 1946, Vol. 51, No. 5, pp. 357–360. In English.)

621.396.611.1 : 621.3.015.3 **3090**

A Note on the Transient Response of an Oscillatory Circuit with Recurrent Discharge.—A. M. Hardie. (*Phil. Mag.*, July 1949, Vol. 40, No. 306, pp. 748–759.) Such circuits were discussed by Wilkinson (864 of 1948). The general characteristics and duration of the transient are here considered and illustrated graphically. The transient response to a voltage step-function is calculated. Account is also taken of circuit losses.

621.396.611.4 **3091**

Approximate Integration of Maxwell's Equations [for stationary e.m. fields] **inside a Cavity Resonator.**—M. Abele. (*Atti Accad. Sci. Torino*, 1945/1947, Vols. 81/82, Part 1, pp. 159–167. Reprint.) Calculations applied in 3823 of 1947.

621.396.611.4 **3092**

Nodal Planes in a Perturbed Cavity Resonator: Parts 2 & 3.—K. F. Niessen. (*Appl. sci. Res.*, 1949, Vol. B1, No. 4, pp. 251–260 & 284–298.) A mathematical paper. The resonator considered is rectangular and has one movable wall. In part 1 (994 of April) a vibration without nodal planes was considered. In part 2 a vibration with a single nodal plane (*a*) perpendicular, (*b*) parallel to the movable wall is discussed. Part 3 is concerned with the case where the vibration in the unperturbed resonator has two nodal planes, one perpendicular and the other parallel to the movable wall. The perturbed field is determined in each case. See also 1330 of May.

621.396.611.4 : 621.392.26† **3093**

The Analogies between the Vibration of Elastic Membranes and the Electromagnetic Fields in Guides and Cavities.—Cherry. (*See* 3040.)

621.396.615 **3094**

Study of the Transmission-Line Oscillator with Ordinary Valves.—R. de Magondeaux. (*Radio franç.*, June & July/Aug. 1949, Nos. 6 & 7/8, pp. 21–24 & 13–19.) Theory of the operation of simple oscillators for wavelengths between 4 and 40 cm. Relations between the various currents and voltages are shown graphically and output, efficiency and radiated power are considered. Such oscillators are particularly suitable for demonstration purposes.

621.396.615 : 621.317.083.7 **3095**

Transistor Oscillator for Telemetering.—F. W. Lehan. (*Electronics*, Aug. 1949, Vol. 22, No. 8, pp. 90–91.) An oscillator used for f.m. of the telemetering transmitter. Advantages are noted. Variation of frequency with transistor temperature is undesirable. Temperature compensation is being investigated.

621.396.615.029.64 : 621.316.726 **3096**

An Analysis of the Sensing Method of Automatic Frequency Control for Microwave Oscillators.—E. F. Grant. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1949, Vol. 37, No. 8, pp. 943–951.) Circuits using a simple cavity resonator for the stable element and either f.m. of the controlled oscillator or modulation of the cavity resonance frequency are analysed to obtain effective discriminator curves which give a null output for the average cavity resonance frequency. The complete a.f.c. loop gain, the best method of decreasing the pulling of the oscillator frequency by the cavity and the pulling of the cavity frequency by a variable-susceptance load are discussed.

621.396.615.17 ⚑ **3097**

Pulsed Stimulator aids Medical Research.—L. A. Woodbury, M. Nickerson & J. W. Woodbury. (*Electronics*, Aug. 1949, Vol. 22, No. 8, pp. 84–85.) A multivibrator-controlled constant-current pulse generator.

Pulse duration, 0.025–1.5 ms. Repetition rate, 0.1–1 000 pulses/sec. Output continuously variable from zero to over 1 000 mA.

621.396.615.17 : 621.317.755 : 621.397.6 **3098**

Television Time Base Linearisation.—A. W. Keen. (*Electronic Engng*, June 1949, Vol. 21, No. 256, pp. 195–198, 223.) Linearity correction by the integration method is discussed. A simple sawtooth generator consisting of a series RC circuit connected across a source of constant d.c. voltage, with a discharge device connected across the capacitor, has an exponential output when the discharger is inoperative. An additional RC circuit can be associated with the generator so that a suitable proportion of the output of the second circuit is added to that of the generator to make the resultant essentially linear. Details of practical correction circuits are discussed.

621.396.615.17 : 621.397.645.001.4 **3099**

Video Amplifier Testing — using a Square-Wave Generator.—T. B. Tomlinson. (*Electronic Engng*, June 1949, Vol. 21, No. 256, pp. 204–208.) The square-wave generator described is of a conventional type using a multivibrator whose output is clipped by means of a valve operating near cut-off. The output of the squaring valve is fed into a cathode follower to prevent waveform deterioration when working into a considerable load-capacitance. Modifications of the square wave by the more common types of distortion are shown and discussed.

621.396.615.18 **3100**

High-Ratio Multivibrator Frequency-Divider.—M. Silver. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, July 1949, Vol. 13, No. 1, pp. 7–9..20.) Theory and description of a stable circuit capable of division ratios as high as 300 : 1. Component details are furnished of a circuit giving a 15-kc/s output from a 4.5-Mc/s input; only two 6SN7 double triodes are required.

621.396.645 **3101**

High-Quality Amplifier: New Version.—D. T. N. Williamson. (*Wireless World*, Aug. 1949, Vol. 55, No. 8, pp. 282–287.) Modifications of an earlier model (2715 of 1947) with construction data and details of the necessary adjustments to give linear response with low harmonic and intermodulation distortion. The impedances for various connections of the output transformer secondary are tabulated. Negative feedback and the prevention of instability are discussed.

621.396.645 **3102**

Some Aspects of Cathode-Follower Design at Radio Frequencies.—F. D. Clapp. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1949, Vol. 37, No. 8, pp. 932–937.) Simple design charts, derived by approximations which are applicable over a wide range of frequency and of circuit parameters, for determining at h.f. the circuit gain, the gain phase angle, the input impedance in resistive and reactive components, the maximum allowable input signal voltage, etc. Various circuit changes which reduce or eliminate the undesirable effects of the grid/cathode capacitance are discussed.

621.396.645 **3103**

A Wide-Band Amplifier (100 c/s to 20 Mc/s).—J. C. Plowman. (*Electronic Engng*, Sept. 1949, Vol. 21, No. 259, pp. 338–340.) A two-stage, filter-coupled amplifier with cathode-follower output, giving an overall gain of 38 db in the frequency range 100 c/s–16 Mc/s, with a slight falling off at higher frequencies.

621.396.645 : 621.3.015.3 **3104**

Design of Optimum Transient Response Amplifiers.—P. R. Aigrain & E. M. Williams. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1949, Vol. 37, No. 8, pp. 873–879.) The method described is derived from operational analysis using Laplace transforms. It is based on transient considerations, and not derived from steady-state theories. Applications to video amplifiers, symmetrical bandpass amplifiers, and unsymmetrical bandpass amplifiers with low-level modulation are discussed.

621.396.645 : 621.3.015.3 **3105**

Transient Response of Wideband Amplifiers.—W. E. Thomson. (*Wireless Engr*, Aug. 1949, Vol. 26, No. 311, pp. 264–266.) A suitable 2-terminal load for a wideband amplifier stage is the ‘ infinite-order critically-damped load ’ discussed in 671 of 1947. This load gives the fastest unit-step response without overshoot. Any desired approximation to the compensating reactance can be obtained by using one of a certain series of networks. The second member of this series consists of one inductor and one capacitor, and gives a result adequate for most practical purposes.

621.396.645 : 621.396.615.142 **3106**

Application of Velocity-Modulation Tubes for Reception at U.H.F. and S.H.F.—M. J. O. Strutt & A. van der Ziel. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1949, Vol. 37, No. 8, pp. 896–900.) Discussion on 1890 of 1948.

621.396.645 : 621.396.813 **3107**

On Criteria for the Permissible Non-Linear Distortion of Amplifiers.—V. F. Schut & C. W. Kosten. (*Appl. sci. Res.*, 1949, Vol. B1, No. 4, pp. 261–267.) The sum of the amplitude of the second harmonic and twice that of the third harmonic appears to be a good criterion. For reproduction of moderate quality this sum should not exceed 24% of the amplitude of the fundamental.

621.396.645.029.3 : 621.385.3 **3108**

A Low-Noise [audio] **Input Tube.**—Knight & Haase. (*See* 3303.)

621.396.645.029.4/.5 **3109**

On the Amplification of the Low Frequencies in Wide-Band Amplifiers.—W. Dillenburger. (*Funk u. Ton*, Aug. 1949, Vol. 3, No. 8, pp. 423–428.) An extension of the frequency band towards the lower frequencies is made possible by a circuit which increases the effective coupling time-constant between two amplifier stages. The effect of the time-constant of the cathode circuit can be completely compensated with a suitably designed anode circuit, so that the frequency characteristic of the amplification is determined only by the coupling member for the stage. A design is given in which the effect of the filter capacitors of the supply unit on the amplitude characteristic at low frequencies is reduced, as well as the kipp oscillations which may occur with more than two stages.

621.396.645.37 **3110**

Feedback Amplifier Design.—H. Mayr. (*Wireless Engr*, Sept. 1949, Vol. 26, No. 312, pp. 297–305.) Discussion of design when the response curve is preselected and has no spurious peaks. A simple general equation is derived which gives the frequency response of the amplifier with feedback if the response of the amplifier without feedback and the frequency characteristics of the feedback network are known. The special case of amplifiers with up to four stages of resistance-capacitance or tuned-circuit coupling, with constant feedback and equal centre frequencies for all stages, is considered; design formulae are given.

621.396.645.371 **3111**

Negative Feedback Amplifiers.—T. S. McLeod. (*Wireless Engr*, Sept. 1949, Vol. 26, No. 312, pp. 312–313.) Comment on 2768 of October (Brockelsby).

621.396.69 **3112**

Circuit Techniques for Miniaturization.—P. G. Sulzer. (*Electronics*, Aug. 1949, Vol. 22, No. 8, pp. 98–99.) Controlled positive feedback between stages can often be used to avoid the necessity for bulky circuit components, such as cathode and screen by-pass capacitors and video-amplifier compensating inductors, with corresponding reduction in both size and cost.

621.397.62 **3113**

Transit-Time Effects in Television Front-End Design.—H. M. Watts. (*Electronics*, Aug. 1949, Vol. 22, No. 8, pp. 158..170.) The effect of transit-time is to add about 4 to the noise figure near the frequency where the transit-time loading conductance equals the desired input conductance. Transit-time effects tend to level out the differences between various circuit combinations, so that as the frequency increases, the reduction of noise from sources other than transit-time decreases in importance.

621.397.645 **3114**

Television Stabilizing Amplifier.—J. L. Schultz. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, May 1949, Vol. 12, No. 5, pp. 12–15..28.) Full circuit details and special features of a unit which can be used in the studio or at the transmitter as a picture-line amplifier, or as a programme amplifier for a line or radio link.

621.396.69 **3115**

Components Handbook. [Book Review]—J. F. Blackburn (Ed.). Publishers: McGraw-Hill Book Co., New York, 1949, 626 pp., $8.00. (*Electronics*, Aug. 1949, Vol. 22, No. 8, pp. 212, 214.) Vol. 17 of the M.I.T. Radiation Laboratory series. Only components developed by or under the sponsorship of the Radiation Laboratory or of primary importance in its work are covered thoroughly, and several important classes of these components have been left out. Most of the data included have not been published before.

GENERAL PHYSICS

535·3 **3116**

Quantitative Evidence for Boundary-Layer Waves in Optics.—H. Maecker. (*Ann. Phys., Lpz.*, 25th June 1949, Vol. 4, No. 8, pp. 409–431.) The existence of such waves is established. Experimental results are in good agreement with Ott's theory (18 of 1943 and 3117 below). The connection between optical boundary-layer radiation and the ray shift in total reflection described by Goos & Hänchen (*ibid.*, 1947, Vol. 1, p. 333) is examined.

535·3 **3117**

On the Reflection of Spherical Waves.—H. Ott. (*Ann. Phys., Lpz.*, 25th June 1949, Vol. 4, No. 8, pp. 432–440.) Previous calculations for the Schmidt 'head wave' [Kopfwelle] for the vertical dipole (18 of 1943) are extended to dipoles with any direction whatever. See also 3116 above.

535·42 **3118**

On the Theory of Diffraction.—W. Franz. (*Z. Phys.*, 1st March 1949, Vol. 125, Nos. 7/10, pp. 563–596.) An approximation method is given for the solution of acoustical and optical diffraction problems, which includes Kirchhoff's diffraction theory as a special case of the first approximation. While Kirchhoff's method is concerned only with diffraction at a black screen, with the present method reflection and refraction can also be treated and its application is not limited to short wavelengths. The first and second approximations are applied to the case of the semi-infinite plane and the higher approximations to that of the small sphere.

535·42 **3119**

An Asymptotic Treatment of Diffraction Problems.—N. G. van Kampen. (*Physica, 's Grav.*, Jan. 1949, Vol. 14, No. 9, pp. 575–589. In English, with French summary.) An asymptotic development of Kirchhoff's integral for $\lambda \to 0$ is given. The first term corresponds to geometrical optics, and includes intensity and phase. The other terms are the corrections for diffraction. The diffraction at the edge of the opening is treated quasi-geometrically. The theory is applied to optical systems, and the third-order aberration constants are calculated.

537·291 + 538·691] : 537·525·92 **3120**

Electron Flow in Curved Paths under Space-Charge Conditions.—B. Meltzer. (*Proc. phys. Soc.*, 1st July 1949, Vol. 62, No. 355B, pp. 431–437.) A general, synthetic method of obtaining rigorous solutions of steady electron flow subject to space-charge forces is presented. The solutions are not obtained for given boundary conditions, but the boundary conditions are deduced from the solutions. Two examples of such solutions, involving strongly curved two-dimensional electron trajectories, are given; the method is in principle capable of giving the solutions of all possible electron flow patterns in three dimensions except perhaps those involving intercrossing trajectories. It is suggested that the subject offers scope for applied mathematical research at least on the same scale as potential theory.

537·311.4 **3121**

Contact Resistance and its Variation with Current.—S. Rudeforth. (*P.O. elect. Engrs' J.*, July 1949, Vol. 42, Part 2, pp. 65–69.) Empirical relationships have been derived for the nonlinear resistance/current characteristics of specified contacts.

537·523.4 **3122**

Calculation of Spark Breakdown Voltages in Air at Atmospheric Pressure.—A. Pedersen. (*Appl. sci. Res.*, 1949, Vol. B1, No. 4, pp. 299–305.) Discussion of a new semi-empirical criterion for breakdown, which depends on the ion density.

538·3 **3123**

The Experimental Basis of Electromagnetism: Parts 3 & 4.—N. R. Campbell & L. Hartshorn: L. Hartshorn. (*Proc. phys. Soc.*, 1st July 1949, Vol. 62, No. 355A, pp. 422–429 & 429–444. Discussion, pp. 444–445.) The principles outlined in previous parts (3091 of 1947 and 1909 of 1948) dealing with the d.c. circuit and electrostatics are here applied to magnetism to show how the basic concepts are defined in terms of the operations performed in measuring them. The vector B is established as measurable everywhere, even within solid bodies. The vector H and the scalar $\mu = B/H$ are shown to be measurable in special circumstances by means of the magnetometer and permeameter, but in general their values depend on a hypothesis, which is stated. The significant facts concerning the magnetic properties of real materials are briefly reviewed.

538·566 **3124**

Diffraction of Electromagnetic Waves by a Perfectly Conducting Plane Screen.—J. P. Vasseur. (*C. R. Acad. Sci., Paris*, 18th July 1949, Vol. 229, No. 3, pp. 179–181.) Copson, in his treatment of the problem, omitted from his equations a curvilinear integral which, though zero in the examples he considered, may be important in other cases. The correct solution is here given, the formulation of the equations being analogous to that of Bethe (706 of 1945).

538.569.4.029.64 **3125**

Microwave Spectroscopy.—W. Gordy. (*Rev. mod. Phys.*, Oct. 1948, Vol. 20, No. 4, pp. 668–717.) General discussion of instruments, experimental methods, spectra of gases, vapours, liquids and solids, and applications.

538.569.4.029.64 + 537.226.2] : 546.212 **3126**

Electrical Properties of Water.—J. A. Saxton. (*Wireless Engr*, Sept. 1949, Vol. 26, No. 312, pp. 288–292.) Anomalous dispersion occurs mainly between the frequencies of 10^3 and 10^6 Mc/s. Over this interval the permittivity of water falls from 80 to 5.5. The ionic conductivity of fresh water is important only at frequencies below 10^3 Mc/s, and that of sea water at frequencies below 2×10^4 Mc/s. The effect of anomalous dispersion on the reflection coefficient of fresh water surfaces is considered. See also 1912–1915 of 1948.

621.3.016.35 **3127**

A New Harmonic Method for Studying the Stability of Linear Systems.—M. Demontvignier & P. Lefèvre. (*Rev. gén. Élect.*, July 1949, Vol. 58, No. 7, pp. 263–279.) The mathematical basis and the physical significance of the usual harmonic methods are reviewed and Nyquist's criterion of stability is generalized. The principles are explained of a new method, of very general application, which can be applied to any linear system, starting from its generalized phase diagram. Several abacs are given which enable the phase and amplitude diagrams to be traced quickly. The method is applied to the theory of the stability of servomechanisms. See also 1568 of 1948 (Rocard) and back references, for which the above U.D.C. would have been preferable.

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

521.15 : 538.12 **3128**

Theory of the Relations between Gravitation and Electromagnetism and their Astrophysical and Geophysical Applications.—A. Gião. (*J. Phys. Radium*, July/Sept. 1949, Vol. 10, Nos. 7/9, pp. 240–249.) Application to space-time of Codazzi's equations for a hypersurface leads to fundamental relations between gravitation and electromagnetism, when the external metric tensor of space-time is interpreted as a tensor of the e.m. field. This interpretation is a consequence of the fundamentals of the author's unitary theory, according to which all the e.m. properties of the universe are described, directly or indirectly, by the external metric tensor of space-time.

Application of general formulae to the particular case of a sphere in rotation without permanent magnetization gives an important relation between the magnetic moment and the moment of inertia, and proves that the general magnetism of large rotating bodies, such as the stars, is a fundamental consequence of their rotation. Formulae are obtained for the e.m. field of a sphere in rotation which explain the general magnetic field of the earth both external to the surface and underneath it. The same formulae can also be applied to the permanent and periodic magnetism of stars. Codazzi's equations lead to a relation between gravitation and the e.s. field which serves to explain both the mean e.s. field of the earth and the maintenance of its charge. See also 1023, 1634 and 2776 of 1948.

523.72.029.63"1949.05.08" : 523.75 **3129**

Exceptional Solar Radio Emission during 8th May 1949.—M. Laffineur & R. Servajean. (*C. R. Acad. Sci., Paris*, 11th July 1949, Vol. 229, No. 2, pp. 110–112.) Records of solar radiation on a wavelength of 54.5 cm, obtained towards sunset at Meudon observatory, showed large variations of intensity, which at times exceeded 5 times that of the quiet sun. Simultaneous spectrohelioscope observations revealed an intense solar eruption.

An increase in the number of atmospherics on a wavelength of 11 500 m was recorded at the same time at Bagneux, Bordeaux, Poitiers and Rabat. A fade-out of the s.w. transmissions from Leipzig on 9.732 Mc/s and from WWV (Washington) on 15 Mc/s was noted at Bagneux.

A very small crochet in the record of the vertical component of the earth's magnetic field was noted at Chambon-la-Forêt observatory. This crochet coincided with a 10-sec jump of 54.5-cm intensity to 4.7 times that of the quiet sun.

Phenomena probably associated with this solar activity were (*a*) a lowering of the critical frequency at 0400 on 11th May, which was the start of a perturbation of the height of the ionized layers, particularly the F_2 layer, which reached an abnormal height between 0600 and 0700 on 13th May; (*b*) a sudden drop in the value of the horizontal component of the earth's magnetic field at 0200 on 11th May, (*c*) a violent magnetic storm on 12th/13th May.

550.383 **3130**

The Magnetic Field within the Earth.—E. C. Bullard. (*Proc. roy. Soc. A*, 7th July 1949, Vol. 197, No. 1051, pp. 433–453.) A discussion on the magnetic effects of motion in the earth's core. Tidal friction, fluctuations in the rate of rotation, nutation and the variation of latitude have negligible magnetic effects. Radioactivity of core material will greatly affect the internal field as a result of thermal convection. This field is larger and more complex than was previously believed and its existence confirms the induction theory of the origin of the secular variation. See also 381 of February.

551.510.535 **3131**

The Ionosphere over Mid-Germany in June 1949.—Dieminger. (*Fernmeldetech. Z.*, Aug. 1949, Vol. 2, No. 8, p. 244.) Continuation of 2792 of October. A whole series of weak and medium disturbances of the F_2 layer were observed during the month.

551.510.535 **3132**

Ionospheric Virtual Height Measurements at 100 kc/s.—R. A. Helliwell. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1949, Vol. 37, No. 8, pp. 887–894.) A simple high-power sounding equipment is described. Results of intermittent night-time measurements of virtual height at vertical incidence are discussed. The virtual height varied between 84 km and as much as 106 km. At night the reflecting layer appears to consist of ionized clouds, in contrast to the more uniform ionization of the regular layers which affect h.f. waves. A rotation of the polarization of the reflected signal relative to that of the transmitted signal was observed.

551.510.535 : 525.624 : 550.384.4 **3133**

Lunar Oscillations in the D-Layer of the Ionosphere.—E. V. Appleton & W. J. G. Beynon. (*Nature, Lond.*, 20th Aug. 1949, Vol. 164, No. 4164, p. 308.) The daily measurements of ionospheric absorption made at Slough during the period 1943–1948, using a frequency of 2 Mc/s, indicate a lunar oscillation in D-layer absorption. If the D-layer electrons move up and down between levels of different electron collision frequency, the oscillation would be almost exactly out of phase with that known to exist in the higher E layer.

551.510.535 : 621.3.087.4 **3134**

New Equipment for the Systematic Recording of Ionospheric Echoes.—Bolle. (*See* 3062.)

551.510.535 : 621.396.11 **3135**

Correlation of Sporadic E Region Ionization over Short Distances and Comparison with Magnetic Disturbances.—V. B. Gerard. (*N.Z. J. Sci. Tech.*, July 1948, Vol. 30, No. 1, pp. 27–37.) Simultaneous observations of sporadic-E ionization were made at points separated by distances up to 40 km, using two fixed stations and portable recording equipment. An approximately linear relationship was found between the correlation coefficient of simultaneous sporadic-E critical frequencies at two points, and the distance between the points. A method of calculating the m.u.f. for sporadic-E communication over distances up to 100 km is outlined. One observation suggests that a particular sporadic-E cloud had a diameter of 540 km and a velocity of 270 km/hr. No relationship between sporadic-E changes and changes in the earth's magnetic field could be detected. See also 3117 of 1948 (Ferrell) and 3410 of 1948 (Revirieux : Lejay).

551.524.4 **3136**

The Vertical Temperature Gradient in the Lower Atmosphere under Daylight Conditions.—G. W. C. Tait. (*Quart. J. R. met. Soc.*, July 1949, Vol. 75, No. 325, pp. 287–292.) An empirical relationship is derived for the first 10–20 m of the atmosphere, in terms of the position of the sun and cloud cover. This relationship is independent of wind speed, and applies to reasonably level surfaces of soil or short vegetation during daylight, but does not apply to open water surfaces.

551.524.7 **3137**

The Thermal Equilibrium at the Tropopause and the Temperature of the Lower Stratosphere.—R. M. Goody. (*Proc. roy. Soc. A*, 7th July 1949, Vol. 197, No. 1051, pp. 487–505.) Continuity of temperature at the tropopause is a necessary condition for stable transition from a state of convective equilibrium to one of radiative equilibrium.

551.594 **3138**

On the Fundamental Problem of Atmospheric Electricity.—T. Schlomka. (*Z. Phys.*, 15th March 1949, Vol. 125, Nos. 11/12, pp. 733–738.) It is shown that Michel's theory (2086 of 1941) is untenable, since it is based on an erroneous assumption. The maintenance of the earth's negative charge requires a process continuously supplying a negative charge to the earth's surface. This, however, is not the case for unipolar induction with a rotating earth, which can only produce a static charge distribution in the atmosphere and within the earth.

551.594.5 **3139**

Auroral Radiation in the 3 000-Mc/s Region.—P. A. Forsyth, W. Petrie & B. W. Currie. (*Nature, Lond.*, 10th Sept. 1949, Vol. 164, No. 4167, p. 453.) Short pulses of radiation were observed on the indicator of a 3 000-Mc/s radar during an auroral display even when the transmitter was off. These pulses arrived in a random manner, in bursts lasting a small fraction of a second. Individual pulses lasted 1–5 μs. See also 2522 of September (Petrie, Forsyth & McConechy).

LOCATION AND AIDS TO NAVIGATION

621.396.9 **3140**

A Forward-Transmission Echo-Ranging System.—D. B. Harris. (*Proc. Inst. Radio Engrs, W. & E.*, July 1949, Vol. 37, No. 7, pp. 767–770.) 1949 I.R.E. Convention paper noted in 1672 of May (No. 92). A proposed system with p.p.i. display for detecting targets such as atmospheric irregularities, which have a low reflection coefficient except at grazing incidence. Transmitter and receiver are about 100 miles apart. Microwave pulses lasting about 0.01 μs are required.

621.396.93 **3141**

V.H.F. Direction Finder for Light Planes.—G. Wennerberg. (*Electronics*, Aug. 1949, Vol. 22, No. 8, pp. 118..140.) This omnirange system provides azimuth information directly in degrees for an aircraft in any position within the line-of-sight range of the transmitting station. The frequency used is within the band 108–132 Mc/s and the system has a useful working range of 50–100 miles. The basic principle is the same as that of the German Sonne system; navigational information is supplied as the time difference at the receiving point between a non-directional signal and one transmitted on a rotating beam from the same transmitter.

621.396.93 **3142**

The Relative Merits of Presentation of Bearings by Aural-Null and Twin-Channel Cathode-Ray Direction-Finders.—S. de Walden & J. C. Swallow. (*Proc. Instn elect. Engrs*, Part III, July 1949, Vol. 96, No. 42, pp. 307–320.) The visual method of bearing display is shown to be superior in nearly all respects except for its relative ineffectiveness at very low signal/noise ratios.

621.396.93 **3143**

The Specification and Measurement of Polarization Errors in Adcock-Type Direction Finders.—W. Ross. (*Proc. Instn elect. Engrs*, Part III, July 1949, Vol. 96, No. 42, pp. 269–277.) For instruments erected not more than about λ/4 above the ground, the 'standard wave error' is the best specification of polarization error, while the 'pick up ratio' for wanted and unwanted fields is appropriate for more elevated systems. The method of test using a nearby elevated transmitter is described in detail; in the frequency range 3–30 Mc/s a loop up to about 1.6 m in diameter at a distance of not less than 100 m may be used. For frequencies below 3 Mc/s the 'local-injection' method of test may be more practicable. The performance of a direction finder is very dependent on the electrical properties of the site.

621.396.93 : 621.396.11 **3144**

Scattering of Radio Waves by Metal Wires and Sheets.—Horner. (*See* 3237.)

621.396.93 : 621.396.677 **3145**

Direction-Finding Site Errors at Very High Frequencies.—H. G. Hopkins & F. Horner. (*Proc. Instn elect. Engrs*, Part III, July 1949, Vol. 96, No. 42, pp. 321–332. Discussion, pp. 340–345.) Theoretical and practical investigations are described, concerned mainly with Adcock-type direction finders. The variation in error with the position of various types of reflecting obstacle is examined and the use of error charts for locating such sources of error on a site is described. Of several practical methods suggested for locating the obstacles, two have been used with success, namely the variation of the azimuth or of the frequency of the transmitter. Methods of suppressing unwanted reflections are considered. A criterion is suggested to express the susceptibility of a direction finder to site error, and is applied to well-known instrumental types.

621.396.932 **3146**

The Design and Characteristics of Marine Radar Equipment.—A. Levin & A. C. D. Haley. (*J. Brit. Instn Radio Engrs*, June 1949, Vol. 9, No. 6, pp. 202–219.) Discussion of the use of radar for coastal navigation and collision warning. Information made available by radar is compared with that available visually. The p.p.i. display is almost always used. The effect of meteorological phenomena on the choice of wavelength, and the limitations imposed by vessel size and the space available for the installation are considered. Experimental procedure for determining the main constants of the radar equipment is described, and typical results are discussed and illustrated.

621.396.933 + 629.139.83 **3147**

What We Learned from the Berlin Airlift.—M. A. Chaffee & R. B. Corby. (*Electronics*, Aug. 1949, Vol. 22, No. 8, pp. 78–83.) The control of the aircraft was achieved by means of a combination of conventional radio ranges and homing beacons with appropriate airborne range receivers, long-range surveillance radar, precision landing-approach radar and v.h.f. voice-communication equipment. The radar system used was the American CPS-5, with a range of more than 100 miles, capable of high accuracy and incorporating moving-target indication. The technique of video-mapping was also used.

621.396.933 **3148**

The Course-Line Computer for Radio Navigation of Aircraft.—F. J. Gross. (*Proc. Inst. Radio Engrs, W. & E.*, July 1949, Vol. 37, No. 7, pp. 830–834.) 1948 I.R.E. Convention paper noted in 2524 of 1948. The range and bearing of an aircraft from a v.h.f. omnirange station are converted into distance from destination and lateral deviation from a selected course. Circular courses may also be flown with the range station at the centre.

621.396.933 **3149**

Modern Air and Ground Instrumentation in America's Air Navigation Program.—D. W. Rentzel. (*Instruments*, June 1949, Vol. 22, No. 6, pp. 492–493 . . 542.) The omnirange system provides a visual indication of the bearing of the aircraft from a fixed station. Associated distance-measuring equipment at the station and a lightweight airborne 'course line computer' enable the pilot to fly a straight course between any two selected points. Two landing aids—Instrument Landing System and Precision Beam Radar—are briefly discussed. For another account see 2236 of August (Sandretto).

621.396.9 **3150**

Principles and Practice of Radar. [Book Review]—H. E. Penrose. Publishers: G. Newnes, London, 42s. (*Engineer, Lond.*, 15th July 1949, Vol. 188, No. 4877, p. 71.) " . . . a book for practical men rather than for theorists . . . deserves a place on any radio engineer's shelves."

621.396.9 **3151**

A Textbook of Radar. [Book Review]—Staff of the Radiophysics Laboratory, Council for Scientific and Industrial Research, Australia. Publishers: Chapman & Hall, London, 1948, 579 pp., 50s. (*Proc. phys. Soc.*, 1st July 1949, Vol. 62, No. 355B, pp. 465–466.) The work of the war-time radiophysics team in Australia. The whole field is covered in 20 chapters by 21 contributors. The editing has been well done and in consequence there are few obscurities and few definite mistakes. It should be of value to any serious student of radio.

621.396.9 **3152**

Microwaves and Radar Electronics. [Book Review]—E. C. Pollard & J. N. Sturtevant. Publishers: J. Wiley & Sons, New York, 1948, 414 pp., $5.00; Chapman & Hall, London, 30s. (*Proc. Inst. Radio Engrs, W. & E.*, July 1949, Vol. 37, No. 7, p. 785; *Wireless Engr*, Sept. 1949, Vol. 26, No. 312, p. 313.) The book presents to the engineer, who has had little or no experience with microwaves, the fundamental and practical aspects of microwave and radar engineering. Only a working knowledge of physics, calculus, and valve theory and practice is assumed.

621.396.9 **3153**

The War History of the Radio Branch. [Book Notice]—Publishers: National Research Council of Canada, Ottawa, Report No. ERA-141, 131 pp. An account of Canadian radar research up to the end of 1945.

MATERIALS AND SUBSIDIARY TECHNIQUES

533.56 **3154**

Design Calculations for Molecular Vacuum Pumps.—R. Risch. (*Schweiz. Arch. angew. Wiss. Tech.*, Sept. 1948, Vol. 14, No. 9, pp. 279–285.)

535.37 **3155**

On the Quenching of the Luminescence of Certain ZnS-Cu and CaS-Bi Phosphors.—F. Bandow. (*Ann. Phys., Lpz.*, 1st Oct. 1947, Vol. 1, Nos. 7/8, pp. 399–404.)

535.37 **3156**

Decay and Quenching of Fluorescence in Willemite.—F. A. Kröger & W. Hoogenstraaten. (*Physica, 's Grav.*, Sept. 1948, Vol. 14, No. 7, pp. 425–441. In English.)

535.37 **3157**

The Influence of Temperature Quenching on the Decay of Fluorescence.—F. A. Kröger, W. Hoogenstraaten, M. Bottema & T. P. J. Botden. (*Physica, 's Grav.*, April 1948, Vol. 14, Nos. 2/3, pp. 81–96. In English.) Temperature quenching increases the rate of decay considerably. The probabilities of fluorescence transition and of radiationless transition are determined separately as functions of temperature; these two probabilities determine both the efficiency of fluorescence and the decay. Results favour the theory of Mott and Seitz for the radiationless process.

535.371.07 : 621.385.832 **3158**

The Physics of Cathode Ray Tube Screens.—G. F. J. Garlick. (*Electronic Engng*, Aug. 1949, Vol. 21, No. 258, pp. 287–291.) Discussion of the characteristics of screen materials, and of the mechanism of processes involved in screen luminescence.

538.22 **3159**

Magnetic Properties of Ferrites; Ferrimagnetism and Antiferromagnetism.—L. Néel. (*Ann. Phys., Paris*, March/April 1948, Vol. 3, pp. 137–198.) Comprehensive discussion, with detailed theory and comparison with experimental results.

538.22 **3160**

Dispersion and Absorption in Magnetic Ferrites at Frequencies above One Mc/s.—J. L. Snoek. (*Physica, 's Grav.*, May 1948, Vol. 14, No. 4, pp. 207–217.) The contribution of the Bloch boundaries to magnetization is neglected at frequencies above 1 Mc/s. For pure and unstrained polycrystalline aggregates of cubic crystals, the critical frequency ω_0 and the initial susceptibility χ satisfy the equation

$$\omega_0\,\chi = \tfrac{3}{2}|g|M$$

where $g = e/mc = 1.76 \times 10^6$, M is the magnetic moment per cm³, and the damping is assumed small. Internal stresses tend to increase the losses at lower frequencies.

538.221 **3161**

Tentative Theory of the Magnetic Properties of Rhombohedric Sesquioxide of Iron.—L. Néel. (*Ann. Phys., Paris*, May/June 1949, Vol. 4, pp. 249–268.)

538.6 **3162**

Systematic Relations existing between the Properties of Solid Materials.—C. Zwikker. (*Physica, 's Grav.*, Jan. 1948, Vol. 14, No. 1, pp. 35–47. In English.) Volume changes due to electrostriction, magnetostriction or Barrett effect are discussed. Four independent relations are found between the following eight quantities: Hall effect, Seebeck effect, Nernst effect, Peltier effect, Ettinghausen effect, Leduc-Righi effect, electric resistivity, and thermal resistivity.

538.652 **3163**

Longitudinal Magnetostriction of the Ferrites of Nickel and Magnesium.—R. Vautier. (*C. R. Acad. Sci., Paris*, 18th July 1949, Vol. 229, No. 3, pp. 177–179.) The ferrites investigated all contained 50% Fe_2O_3, with either NiO or MgO in proportions up to 50%, the remainder being ZnO. Results are shown graphically.

546.212-16 : 621.317.335.3† **3164**

The Electrical Behaviour of Ice.—F. X. Eder. (*Ann. Phys., Lpz.*, 1st Oct. 1947, Vol. 1, Nos. 7/8, pp. 381–398.) See 1077 of 1948.

548.0 : 537.228.1 **3165**

Piezoelectric Resonator of Ethylene Diamine Tartrate with Zero Temperature Coefficient of Frequency.—R. Bechmann. (*Nature, Lond.*, 30th July 1949, Vol. 164, No. 4161, pp. 190–191.) For the contour shear mode in square plates with two sides parallel to the y axis and with the normal in the xz plane, the temperature coefficient of frequency is zero when θ, the angle between the normal and the x axis, is 17° or 77°.

621.315.5/.6 + 669 **3166**

The Development of New Materials.—F. E. Robinson. (*Marconi Rev.*, July/Sept. 1949, Vol. 12, No. 94, pp. 108–116.) Discussion of metals, alloys and insulating materials developed during the war and only recently released to industry.

621.315.5/.6 **3167**

Materials Section.—(*Electronics, Buyers' Guide Issue*, June 1949, Vol. 22, No. 6A, pp. M1–M32.) Electrical, mechanical and other significant characteristics of various materials used by the electronic industry are tabulated. Some of the tables are new; others are revised forms of tables such as those noted in 3131, 3133, 3142, 3146, 3150 and 3152 of 1948.

621.315.59 : 546.281.26 **3168**

The Structure and Electrical Properties of Surfaces of Semiconductors: Part 1 — Silicon Carbide.—T. K. Jones, R. A. Scott & R. W. Sillars. (*Proc. phys. Soc.*, 1st June 1949, Vol. 62, No. 354A, pp. 333–343.)

621.315.59 : 621.3.011.2 **3169**

The Temperature Dependence of the Resistance of Semiconductors.—J. H. Gisolf. (*Ann. Phys., Lpz.*, 3rd Jan. 1947, Vol. 1, Nos. 1/3, pp. 3–26.)

621.318.22 **3170**

Permanent Magnets and the Electrical Industry.—A. Edwards. (*Electrician*, 20th May 1949, Vol. 142, No. 3701, pp. 1567–1571.) The magnetic energy of an Alcomax-III magnet is nearly 20 times that of the best magnet of equal size available 30 years ago. Corresponding advances in stability have also taken place. The properties and treatment of Alcomax and other materials are discussed, and the magnet shapes required for various applications are considered.

621.318.42 : 538.213 **3171**

A Method, based on the Gans Function, for Calculating the Effective Permeability of Premagnetized Choke Cores.—A. Weis. (*Funk u. Ton*, Aug. 1949, Vol. 3, No. 8, pp. 438–448.) Calculation from the B/H curve gives values for the effective permeability which are much too high. The method here described gives results in good agreement with measured values for air-gap chokes.

621.775.7 **3172**

Methods of Iron Powder Manufacture and their Influence on Powder Properties.—H. Bernstorff. (*Metal Treatm.*, Summer 1949, Vol. 16, No. 58, pp. 93–102.) A review of various German methods, including grinding, atomization, chemical reduction, and electrolysis. The influence of particle size and shape (shown in micrographs) on some of the physical properties of the finished product is discussed.

669.018 : 621.3.011.2 **3173**

Pressure and Temperature Coefficients of the Electrical Resistance of Certain Alloys.—H. Ebert & J. Gielessen. (*Ann. Phys., Lpz.*, 22nd May 1947, Vol. 1, Nos. 4/5, pp. 229–240.) The results of measurements on a large number of alloys, including invar, thermostan, constantan, manganin, and series of Ag/Mn, Au/Mn and Cu/Cr alloys, are presented graphically. The greatest pressure coefficient noted was 3.7×10^{-6} per atmosphere for a Ag/Mn alloy with about 15% (by weight) of Mn. The results indicated a relation between the two coefficients for a series of alloys, the pressure coefficient decreasing with increasing temperature coefficient.

533.5 **3174**

Scientific Foundations of Vacuum Technique. [Book Review]—S. Dushman. Publishers: J. Wiley & Sons, New York, 1949, 882 pp., $15.00. (*Rev. sci. Instrum.*, June 1949, Vol. 20, No. 6, p. 453.) The book covers the applications and fundamentals of vacuum technology in the fields of physics, chemistry and metallurgy. The completeness of the work recommends it as a reference book.

MATHEMATICS

517.512 : 621.3.015.3 **3175**

Contribution to the Study of Transient Phenomena by means of Time Series.—M. Cuénod. (*Bull. tech. Suisse romande*, 30th July 1949, Vol. 75, No. 16, pp. 201–209.) The practical advantages of this method of calculation are considered. The method is outlined and applied to the determination of the response curve of a system and to integration, differentiation, the solution of linear differential equations and the determination of the conditions of stability of an automatic regulator. The relation between operational calculus and time-series methods is also indicated.

681.142 **3176**

Electronic Techniques applied to Analogue Methods of Computation.—G. D. McCann, C. H. Wilts & B. N. Locanthi. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1949, Vol. 37, No. 8, pp. 954–961.) The electronic devices and principles developed for the California Institute of Technology general-purpose, large-scale computer are described. This computer can be used for solving algebraic, ordinary differential or partial differential equations, both linear and nonlinear.

681.142 **3177**

Principles and Progress in the Construction of High-Speed Digital Computers.—A. D. Booth & K. H. V. Britten. (*Quart. J. Mech. appl. Math.*, June 1949, Vol. 2, Part 2, pp. 182–197.) Consideration of: (*a*) the basic principles underlying the mathematical design of high-speed digital computers, (*b*) the necessary components of such machines, (*c*) scale of notation, the form of the 'memory', the action of the control, and other practical details, (*d*) the exact arithmetic functions of which these machines must be capable, (*e*) current computer projects in America, including Aiken's second relay computer at Harvard, the Bell relay machine, E.D.V.A.C., and the Princeton electronic computer, with reference to their state of completion in 1947.

681.142 **3178**

A Digital Computer for Scientific Applications.—C. F. West & J. E. DeTurk. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1949, Vol. 37, No. 8, p. 861.) Correction to 1107 of April.

681.142 **3179**

A Magnetic Digital Storage System.—A. D. Booth. (*Electronic Engng*, July 1949, Vol. 21, No. 257, pp. 234–238.) The storage device consists of a cylindrical drum coated with magnetic material and rotating under a series of read/record heads arranged along a generator of the cylinder. Numbers are recorded in sequence as the drum rotates; to distinguish between them an extra track is added which contains a set of equally spaced positive 'clock' pulses. The start of the clock pulse track is indicated by leaving a small gap free from pulses and using this as the zero position from which the position of any number can be obtained. Circuit and practical details are given.

681.142 : 621.392.5 **3180**

Mercury Delay Line Memory using a Pulse Rate of Several Megacycles [per second].—Auerbach, Eckert, Shaw & Sheppard. (*See* 3082.)

517.564.4 **3181**

Spherical Harmonics. [Book Review]—T. M. MacRobert. Publisher: Dover Publications, New York, 2nd edn 1948, 367 pp., $4.50. (*Proc. Inst. Radio Engrs, W. & E.*, July 1949, Vol. 37, No. 7, p. 785.) Fourier series and Bessel, Legendre and hypergeometric functions are covered as well as spherical harmonics. There is insufficient explanatory material for the engineer, but the treatment is thorough and useful for the applied mathematician.

517.63 **3182**

An Introduction to the Laplace Transformation. [Book Review]—J. C. Jaeger. Publishers: Methuen & Co., London, 132 pp., 7s. 6d. (*Wireless Engr*, Aug. 1949, Vol. 26, No. 311, p. 276.) "The book contains the substance of a course of lectures delivered to engineers and physicists at the National Standards Laboratory, Sydney, in 1944 . . . [It] contains as little theory as possible; it is, in fact, largely a collection of worked examples illustrating the methods of solution of the various types of problem commonly arising in circuit theory."

MEASUREMENTS AND TEST GEAR

531.764.5 : 621.396.615.18 **3183**

A Compact Piezoelectric Chronometer.—J. E. Benson & E. M. Dash. (*Proc. Instn Radio Engrs, Aust.*, Aug. 1948, Vol. 9, No. 8, pp. 4–8. Discussion, p. 8.) See 1113 of April.

621.317.083.7 **3184**

Radio Telemetering.—G. L. Hinckley. (*Electronic Engng*, June 1949, Vol. 21, No. 256, pp. 209–211, 223.) Factors influencing the choice of system.

621.317.3 **3185**

Measurement of Impedance, Capacitance, Inductance and Frequency by the Method of Proportional Currents.—A. I. Fürstenberg. (*C. R. Acad. Sci. U.R.S.S.*, 10th Feb. 1946, Vol. 51, No. 4, pp. 277–280. In English.) A method consisting essentially in equalizing the potential drop across constant nonreactive resistances in series with the impedances. A source of constant voltage and frequency is required.

621.317.3 : 621.385.38 **3186**

The Deionization Time of Thyratrons: A New Method of Measurement.—H. de B. Knight. (*Proc. Instn elect. Engrs*, Part III, July 1949, Vol. 96, No. 42, pp. 257–261.) A circuit providing two firing pulses at an adjustable interval is used to measure the time required to re-establish grid control. Typical deionization times and grid-current decay curves are given for various valve structures and fillings. See also 2553 of September (Birnbaum).

621.317.312 : 621.314.632 **3187**

Use of Copper-Oxide Rectifiers for Measuring the Smallest Alternating Voltages.—H. Ifland. (*Funk u. Ton*, Aug. 1949, Vol. 3, No. 8, pp. 449–454.) Temperature effects in the bridge type of rectifier normally used with moving-coil instruments for a.c. measurements can be partially compensated by connecting a resistor of suitable value in series with the instrument. Circuit details are given of a multi-range meter with full-scale readings from 0.1 V to 300 V.

621.317.33 : 621.396.611.33 **3188**

Simplified Measurement of L and k.—V. A. Sheridan. (*Electronics*, Aug. 1949, Vol. 22, No. 8, pp. 146 . . 154.) The coupling coefficient k is determined from the change in effective inductance of one winding of a pair of inductively coupled circuits when the other winding is first open-circuited and then short-circuited. Accuracies within 1% are obtained with the bridge described, which is fed through a double-tuned transformer from a 23-kc/s oscillator and is suitable for measurements on most r.f. transformers.

621.317.333.4 : 621.315.23 **3189**

Cable Fault Finder.—F. E. Planer. (*Elect. Rev., Lond.*, 8th July 1949, Vol. 145, No. 3737, pp. 57–58.) Short description of portable inductive test equipment. A conductor carrying 1 mA a.c. can be detected at a distance of 45 ft. A direct indication of cable depth is given.

621.317.335.3† **3190**

Construction of Apparatus for Very Accurate Measurement of the Dielectric Constant of Liquids.—Mouradoff-Fouquet. (*Ann. Phys., Paris*, May/June 1949, Vol. 4, pp. 310–367.) A double-beat method using oscillations of medium wavelength, with capacitors of extremely accurate mechanical construction for containing the liquids and with arrangements for maintaining the temperature at any desired value, enabled the dielectric constant of various organic liquids to be measured to about 1 part in 20 000.

621.317.335.3† : 546.212-16 **3191**

The Electrical Behaviour of Ice.—F. X. Eder. (*Ann. Phys., Lpz.*, 1st Oct. 1947, Vol. 1, Nos. 7/8, pp. 381–398.) See 1077 of 1948.

621.317.336 : 621.317.372 **3192**

The Development of *Q*-Meter Methods of Impedance Measurement.—A. J. Biggs & J. E. Houldin. (*Proc. Instn elect. Engrs*, Part III, July 1949, Vol. 96, No. 42, pp. 295–302. Discussion, pp. 303–305.) Three usual definitions of Q are shown to be equivalent for a system at simple resonance. Circuit magnification factor is discussed in relation to Q, and circuits for measuring Q are critically examined. A new high-impedance injection meter is described and illustrated, with details of precautions necessary for h.f. measurements.

621.317.336.1 : 621.392.52 **3193**

Measurements on Intermediate-Frequency Transformers.—E. Stern. (*J. Brit. Instn Radio Engrs*, April 1949, Vol. 9, No. 4, pp. 157–166.) A method is described for testing double-tuned transformers with a Q-meter or any other r.f. resistance meter. The resonance transfer impedance of two coupled circuits is expressed in a form independent of the nature of the coupling reactance. Charts are provided from which the transfer impedance of a transformer can be determined from three Q-meter readings. These readings can also be used to determine the frequency response curve from published generalized response curves if the tuning capacitances are known. Simple formulae for the bandwidth at −60 db of composite systems containing single- and double-tuned circuits of different dynamic resistances and coupling are also given. Reprinted from *Proc. Instn Radio Engrs, Aust.*, Jan. 1948, Vol. 9, No. 1, pp. 4–11.

621.317.361 : 621.385.832 **3194**

A Cathode-Ray Tube Frequency Comparator for 1 kc/s Sub-Standard Tones.—F. J. M. Laver. (*P.O. elect. Engrs' J.*, July 1949, Vol. 42, Part 2, pp. 61–64.) The nominal 1-kc/s tone transmitted by land line from a distant source is applied to the X plates of a c.r. tube which is modulated in brilliancy by means of a 100-kc/s frequency standard. The movement of the resultant dot pattern is used to compare the two frequencies rapidly. The method is more reliable than a heterodyne method in the presence of noise or interference voltages. Applications, sources of error, and accuracy are discussed.

621.317.382.029.64 **3195**

Broad-Band Power-Measuring Methods at Microwave Frequencies.—L. E. Norton. (*Proc. Inst. Radio Engrs, W. & E.*, July 1949, Vol. 37, No. 7, pp. 759–766.) The first method uses the forces due to the e.m. fields in a transmission system to cause displacements of a diaphragm which are proportional to the square of the actuating field. In the second method, thin films are inserted in a transmission system so as to cause only small discontinuities. The small fraction of the power dissipated in the film raises its temperature and changes its resistance, which is measured. In both methods the output of the indicator system is proportional to the power within ±1 db between 1 000 and 10 000 Mc/s.

621.317.66 **3196**

Measurement of Microwave-Transmission Efficiency.—A. L. Cullen. (*Wireless Engr*, Aug. 1949, Vol. 26, No. 311, pp. 255–257.) The transmission efficiency of any transmission device is defined as the ratio (power out)/(power in) when the device is inserted in an otherwise matched transmission system. If the reflection coefficient for waves incident on the normal output end of the device, with the input end closed by a movable short-circuiting plunger, is plotted in the complex plane for several positions of the plunger, the points obtained will lie on a circle of radius equal to the transmission efficiency.

621.317.66 : 621.39 **3197**

Measurement of Telecommunications Efficiency.—(*Proc. Instn elect. Engrs*, Part III, July 1949, Vol. 96, No. 42, pp. 277–278.) Report of an I.E.E. discussion meeting. No satisfactory objective test of quality is as yet available; existing subjective tests of loudness and intelligibility are compared.

621.317.7.029.63 **3198**

Measurement Apparatus for Decimetre Waves.—H. H. Meinke. (*Fernmeldetech. Z.*, July 1949, Vol. 2, No. 7, pp. 197–200.) Illustrations and short general description of (*a*) equipment comprising supply unit, transmitter, circular transmission-line for impedance measurement (see 3203 below), receiver and c.r.o. indicator, (*b*) capacitive voltage divider, (*c*) diode, (*d*) transmission line of length variable as in a trombone, (*e*) reactive transmission-line of characteristic impedance 70 Ω, (*f*) bolometer for power measurement in the range 10^{-2}–10^{-6} W.

621.317.715 **3199**

The Alternating Current Galvanometer.—J. M. W. Milatz, P. M. Endt, C. T. J. Alkemade & J. T. Olink. (*Physica, 's Grav.*, May 1948, Vol. 14, No. 4, pp. 260–268. In English.) Theory is given which takes into account the induction current caused by the vibration of the moving system. The galvanometer can be made aperiodic and 'field independent' with a combination of a.c. and d.c. magnetic fields, or with another damping device replacing the d.c. field. Measurements confirming the theory are described.

621.317.715 **3200**

On the Limit of Sensitivity of Galvanometers.—M. Surdin. (*J. Phys. Radium*, July/Sept. 1949, Vol. 10, Nos. 7/9, pp. 253–254.) A formula is established giving the spectral intensity of the Brownian couple which acts on a mechanical or an electrical system satisfying a linear differential equation of the second order and having a single degree of freedom. It is deduced that the sensitivity limit of a galvanometer remains the same whether the measurement circuit is open or closed.

621.317.715 **3201**

Valve Galvanometer with Ordinary Valves.—J. Kreuzer. (*Z. Phys.*, 15th March 1949, Vol. 125, Nos. 11/12, pp. 707–714.) Special electrometer valves are normally used in apparatus for the measurement of very small currents such as that given by a photocell, but with ordinary valves currents as low as 10^{-13} A can be measured and a limit of 10^{-14} A may be reached with selected valves. Details of practical equipment using a KF4 pentode, which has a well-insulated grid, are given.

621.317.73 : 549.514.51 **3202**

The Measurement of the Series-Resonant Resistance of a Quartz Crystal.—L. A. Rosenthal & T. A. Peterson, Jr. (*Rev. sci. Instrum.*, June 1949, Vol. 20, No. 6, pp. 426–429.) Two methods of measuring the equivalent resistance of commercial plated or pressure-mounted quartz crystals in the frequency range 80 kc/s–100 Mc/s are discussed, namely (*a*) the substitution method, in which a resistor replaces the crystal unit, the amplitude of oscillation being maintained constant, and (*b*) the calculation method, in which the quantities actually measured are the voltage drop across the crystal and the current through the unit. Three instruments are described in which combinations of these methods are used. Typical results are discussed.

621.317.73.029.63 **3203**

A Measurement Line with Visual Indicator.—H. H. Meinke. (*Fernmeldetech. Z.*, Aug. 1949, Vol. 2, No. 8, pp. 233–241.) A device for measuring impedance in the dm-λ range. It consists essentially of a transmission line forming nearly a complete circle, with a motor-driven rotary radial arm making contact with both the inner and outer conductor. The actual instrument is accurately machined and the end of the rotary arm makes contact with the inner conductor through a slot on the inner face of the line. A generator is connected to one end of the line, which is terminated by the impedance to be measured. Capacitive couplings to the two contacts on the rotary arm enable the shape of the voltage wave along the line to be displayed on a c.r.o. The voltage picked up by the contacts is amplified, heterodyned to give a difference frequency of 3 Mc/s and, after further amplification and rectification, applied to the c.r.o. Typical oscillograms are given, the method of calibration is described and also applications to phase measurement and to various measurements on receivers and transmitters. The apparatus is one unit of the equipment noted in 3198 above.

621.317.772 **3204**

Resistive Phase Shifters.—J. E. Bryden. (*Electronic Engng*, Sept. 1949, Vol. 21, No. 259, pp. 322–326.) Description of a phase-shifter for which power is supplied from an electronic single-phase/6-phase conversion unit. Advantages, possible errors and their elimination, and applications are discussed.

621.317.78.029.64 **3205**

Broadband Bolometric Measurement of Microwave Power.—H. J. Carlin. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, July 1949, Vol. 13, No. 1, pp. 16–19.) Theory and description of broad-band units for the ranges 20–1 000 Mc/s, 1 000–4 000 Mc/s and 4 000–10 000 Mc/s. One type, using Wollaston wire, is suitable for low-power measurements from 25 μW to 1 mW, with extension to 10 mW if an attenuator is used. Another type uses metal film for powers from 1 mW to 50 mW, with extension to 5 W. Typical curves for voltage s.w.r. are given.

621.319.4.001.4 **3206**

Direct Voltage Performance Test for Capacitor Paper.—H. A. Sauer & D. A. McLean. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1949, Vol. 37, No. 8, pp. 927–931.) Discussion of a testing procedure requiring about a day for preparation of samples and about another day for the actual life test. See also 965 of 1948 (McLean).

621.395.623.7.089.6 **3207**

Physical Measurements of Loudspeaker Performance.—P. S. Veneklasen. (*J. Soc. Mot. Pict. Engrs*, June 1949, Vol. 52, No. 6, pp. 641–656.) Facilities for outdoor calibration of loudspeakers and microphones at the Altec Lansing Corporation, California, are described. Techniques are illustrated by measurements of frequency response, angular distribution and distortion for a typical loudspeaker. Methods for uniform presentation of performance data and specifications are also suggested. Smooth and clean reproduction over a limited range of frequencies should be achieved before wide-range reproduction will be worth while.

621.396.615 **3208**

Beat-Frequency Oscillator for the Carrier-Frequency Range.—H. Boucke & H. Lennartz. (*Fernmeldetech. Z.*, Aug. 1949, Vol. 2, No. 8, pp. 245–248.) Details of a 1944 model, Type SR200R, which is not limited to carrier frequencies, its frequency range being from 50 c/s to 200 kc/s. Curves show the output voltages into 150-Ω and 600-Ω loads for the two ranges 50–15 000 c/s and 10–200 kc/s. Distortion curves are also given.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

538.63 **3209**

Focusing Properties and Separating Power of a Magnetic Field bounded by Parallel Planes.—R. Vauthier. (*C. R. Acad. Sci., Paris*, 18th July 1949, Vol. 229, No. 3, pp. 181–183.) Such a magnetic field can be used in the construction of a mass spectrometer, the separating power being nearly equal to that of a magnetic sector.

539.16.08 **3210**

An Automatic Timer for Radioactivity Measurements.—B. D. Corbett & A. J. Honour. (*Electronic Engng*, Sept. 1949, Vol. 21, No. 259, pp. 341–345.) Circuit and construction details for a timer to be used in conjunction with a commercial electronic scaler developed by the Atomic Energy Research Establishment. Hundreds of counts, minutes and seconds are displayed on three easily reset dial-type registers. The duration of operation may be preset in the range 1 sec–200 min, or alternatively the number of counts may be preset in the range 100–20 000. Units and tens of counts are displayed by means of neon lamps.

539.16.08 **3211**

Geiger Counter Tubes.—H. Friedman. (*Proc. Inst. Radio Engrs, W. & E.*, July 1949, Vol. 37, No. 7, pp. 791–808.) Discussion of various types and their special characteristics and applications. 68 references are given.

539.16.08 **3212**

Geiger-Müller Counters with External Cathode.—D. Blanc & M. Schérer. (*C. R. Acad. Sci., Paris*, 27th June 1949, Vol. 228, No. 26, pp. 2018–2020.) The performance of this type of counter is improved by connecting the graphite coatings on the ends of the tube to the axial wire, thus eliminating end effects. The curve for counting rate as a function of the length of the central graphite cathode, for a given voltage, is then a straight line passing through the origin. The plateau is lengthened by 50% or more compared with normal counters. Argon-alcohol and argon-methane counters were investigated, of lengths from 20 cm to 1 m and diameters from 0.9 cm to 3.5 cm. Improved results were obtained in all cases. Counters which were defective or had poor plateaux could be reconditioned by the graphite-coating technique.

539.16.08 **3213**

Point Counters and Counter Tubes for Surface Investigations in Metallography.—J. Kramer. (*Z. Phys.*, 15th March 1949, Vol. 125, Nos. 11/12, pp. 739–756.) Many examples are given showing the wide scope of counter methods in such research.

539.16.08 **3214**

Experiments in the Possibility of Increasing the Efficiency of Gamma-Counters.—H. Slätis. (*Rev. sci. Instrum.*, May 1949, Vol. 20, No. 5, pp. 353–354.) Abridged version of 2873 of October.

549.211 : 539.16.08 **3215**

Removal of Space-Charge in Diamond-Crystal Counters.—A. G. Chynoweth. (*Phys. Rev.*, 15th July 1949, Vol. 76, No. 2, p. 310.) The use of radiation from a Nernst filament, of wavelength 1–10 mμ, is quite satisfactory for removing the space charge which causes decay of counting rate.

620.179.16 : 534.23 **3216**

On Sound Transmission through Metal Plates in Liquids for Oblique Incidence of Plane Waves.—Götz. (*See* 2998.)

621.317.083.7 : 621.396.615 **3217**

Transistor Oscillator for Telemetering.—Lehan. (*See* 3095.)

621.38.001.8 **3218**

Electronic Equipment for the Production Engineer.—(*J. Brit. Instn Radio Engrs*, June 1949, Vol. 9, No. 6, pp. 222–237.) Report of a discussion. Examples demonstrate the wide range of operations that, by the development of new or the adaptation of existing instruments, can be controlled or carried out, rapidly and reliably, by electronic means. Specialization is essential in so wide a field. Selected electronic control units are illustrated and described.

621.38.001.8 **3219**

The Fourth Manchester Electronics Exhibition.—(*Electronic Engng*, Sept. 1949, Vol. 21, No. 259, pp. 336–337.) Brief descriptions of various exhibits, including evaporating and sputtering plant, a servodyne, a c.r.o., a valve test panel, an electron microscope, an inductance bridge, a microsecond chronometer, etc.

621.38.001.8 **3220**

Electronic Equipment at the B.I.F.—(*Electronic Engng*, June 1949, Vol. 21, No. 256, pp. 224–227.) Brief descriptions of various exhibits.

621.38.001.8 : 621 **3221**

Electronics in Heavy Engineering.—W. Wilson. (*J. Brit. Instn Radio Engrs*, Aug. 1949, Vol. 9, No. 8, pp. 278–305.) A comprehensive review including discussion of high-power rectifiers, industrial h.f. generators, amplification and control apparatus, servomechanisms, motor control, and applications of the c.r.o.

621.384.6 **3222**

Beam Extraction for the Electron Centrifuge.—K. Gund & H. Reich. (*Z. Phys.*, 27th May 1949, Vol. 126, No. 5, pp. 383–398.) Discussion of the problem for the betatron, synchrotron and f.m. cyclotron, and description of a method permitting 70% of the electrons to be extracted in the form of a narrow beam.

621.384.611.2† **3223**

Hospital Synchrotron.—J. H. Martin. (*Elect. Rev., Lond.*, 12th Aug. 1949, Vol. 145, No. 3742, pp. 277–279.) The first of two 30-MeV synchrotrons designed for the Medical Research Council has recently been installed at the Royal Cancer Hospital, London. Photographs and a few technical details of the equipment are given. The total weight is about 3 tons.

621.384.611.2† **3224**

The Synchrotron Accelerator — its Potentialities as a Generator of X-Rays and Electrons of 10-50 MeV Energies for Medical Use.—D. W. Fry. (*Brit. J. Radiol.*, Aug. 1949, Vol. 22, No. 260, pp. 462–472.) The principle of the electron synchrotron is considered and the main characteristics of a β-synchrotron are illustrated by reference to the operation of a 14-MeV and a 30-MeV electron synchrotron. With the 30-MeV machine an output of 13 r/min at 1 m has been obtained. The X-ray characteristics are described and the possibility of extracting the electron beam for clinical use is discussed. The main factor controlling the design of both betatrons and synchrotrons at present is the injection process. If the efficiency of injection could be increased, a major improvement would result in synchrotrons and betatrons designed for clinical work.

621.384.62† **3225**

The Microwave Linear Electron Accelerator.—G. R. Newbery. (*Brit. J. Radiol.*, Aug. 1949, Vol. 22, No. 260, pp. 473–486.) Various types are briefly described and a detailed account is given of travelling-wave, standing-wave and multi-cavity accelerators. The theoretical and practical limitations of the performance of each type at 3 000 Mc/s are discussed. The design of linear accelerators, suitable for medical use at this frequency, is considered; tentative designs for 5-MeV and 10-MeV machines are given.

621.385.832 : [535 + 77 **3226**

Cathode-Ray-Tube Applications in Photography and Optics.—C. Berkley & R. Feldt. (*J. Soc. Mot. Pict. Engrs*, July 1949, Vol. 53, No. 1, pp. 64–85.) Reprint of article noted in 2596 of September.

621.397.3 : 539.211 **3227**

The Electron Scanner — an Image Method using Secondary Electrons.—H. te Gude. (*Funk u. Ton*, July 1949, Vol. 3, No. 7, pp. 373–383.) Principles and construction of apparatus using an electron beam for scanning a surface to be examined, and obtaining an image by means of the secondary electrons emitted from the surface. Applications to the investigation of surface films, such as those of Cu_2O rectifiers, and to corrosion research are mentioned. See also 4111 of 1939 (Knoll & Theile) and 2509 and 3593 of 1941 (Knoll).

620.179.16 : 534.321.9 **3228**

Ultrasonics. [Book Review]—Carlin. (*See* 3032.)

PROPAGATION OF WAVES

538.56 : 535.421 **3229**

On the Diffraction of a Plane Wave by a Semi-Infinite Conducting Sheet.—C. W. Horton. (*Phys. Rev.*, 15th April 1949, Vol. 75, No. 8, p. 1263.) At radar frequencies the detecting unit is much smaller than the region in which Sommerfeld's diffraction formulae are invalid.

Approximate expressions are here given for the electric vector of the diffraction field within the excluded regions, when the electric vector is parallel to the edge of the screen, with similar expressions for the magnetic vector when this is parallel to the diffracting edge. The symbols used are those defined by Baker & Copson (2907 of 1940).

538.566 + 621.396.11 **3230**

On the Propagation of Radio Waves around the Earth.—H. Bremmer. (*Physica, 's Grav.*, June 1948, Vol. 14, No. 5, pp. 301–318. In English.) A general discussion of existing theories and the extensions required by the discovery of new phenomena like super-refraction. For a fuller account see 3242 below.

538.566 **3231**

Reflection of Electromagnetic Waves at an Inhomogeneous Layer.—W. Kofink. (*Ann. Phys., Lpz.*, 3rd Jan. 1947, Vol. 1, Nos. 1/3, pp. 119–132.) Mathematical study of several methods of calculating the reflecting power of a layer in which the dielectric constant varies with depth in the layer. The essentials of the following methods are presented: (*a*) the functional method; (*b*) the method of van Cittert; (*c*) the method of Gans (WKB method); (*d*) a differentiation method. (*c*) and (*d*) are only applicable to layers of finite thickness.

538.566.3 **3232**

On the Theory of the Double Refraction of Electromagnetic Waves in an Ionized Gas under the Influence of a Constant Magnetic Field (Ionosphere).—H. Lassen. (*Ann. Phys., Lpz.*, 1st Oct. 1947, Vol. 1, Nos. 7/8, pp. 415–428.) The complex refractive index and the waveform are calculated in a simple manner. A relation is established between previous calculations by Försterling and the author and the formulae of Appleton, Goldstein and Hartree.

621.396.11 **3233**

Ground-Wave Propagation across a Land/Sea Boundary.—G. Millington: N. Elson. (*Nature, Lond.*, 16th July 1949, Vol. 164, No. 4159, pp. 114–116.) An increase of field strength on crossing the coastline was observed by Millington for 3.13-Mc/s radiation along a path passing for about 100 km over land and then across the English Channel. The field strengths along this path are shown graphically; the results confirm the theory previously given (1758 of June). See also 2307 of August.

Measurements of the field strength of 1.122-Mc/s transmissions from Crowborough were made by Elson in an aircraft flying at a height of 1 000 ft across East Anglia and then over the North Sea. At the frequency used, both land and sea are essentially conducting. A major recovery of field strength was noted about 25 miles beyond the coastline. The results confirm Millington's theory. A small recovery effect was noted on crossing the Thames estuary.

621.396.11 : 551.510.535 **3234**

Correlation of Sporadic E Region Ionization over Short Distances and Comparison with Magnetic Disturbances.—Gerard. (*See* 3135.)

621.396.11 : 551.510.535 : 518.3 **3235**

Nomograms for Ionosphere Control Points.—J. C. W. Scott. (*Proc. Inst. Radio Engrs, W. & E.*, July 1949, Vol. 37, No. 7, pp. 821–824.) An abac for determining the latitudes of the ionospheric control points, given the length of a radio circuit and the latitudes of its terminals. This simplifies the use of world m.u.f. charts.

621.396.11 : 621.396.812.3 **3236**

On the Fading of Short Waves.—W. Menzel. (*Fernmeldetech. Z.*, Aug. 1949, Vol. 2, No. 8, pp. 243–244.) Discussion with special reference to Ratcliffe's theory (193 of January).

621.396.11 : 621.396.93 **3237**

Scattering of Radio Waves by Metal Wires and Sheets.—F. Horner. (*Proc. Instn elect. Engrs*, Part III, July 1949, Vol. 96, No. 42, pp. 333–340. Discussion, pp. 340–345.) Formulae for the scattered fields are derived, using transmission-line theory for wires and diffraction theory for sheets. Measurements of the scattered fields have been made at a frequency of 600 Mc/s, using a direction finder as the indicating instrument; the results are in substantial agreement with theory. For wires of the order of 1 mm in diameter and more than 5 λ long, resonance effects at 600 Mc/s are small. Such effects are negligible in sheets whose dimension normal to the electric vector is greater than λ.

621.396.81 **3238**

Reception at over 16 000 km from the Transmitter.—R. G. Sacasa. (*Rev. Telecomunicación, Madrid*, June 1948, Vol. 3, No. 12, pp. 11–15.) Graphs show the variations during March 1948 of receiver output power at Madrid for Australian broadcasting stations on wavelengths of 16.82, 19.74 and 25.49 m. Measurements were made daily at 0730 GMT at peak modulation. Comparison with measurements on the 32-m signals from the Arganda station, Madrid, only 17 km from the receiving station, revealed definite correlation with the variations of the Australian 25.49-m signals.

621.396.812 **3239**

Anomalous Radar Propagation over Land in the Period November 29 to December 1, 1948.—R. F. Jones. (*Met. Mag.*, Aug. 1949, Vol. 78, No. 926, pp. 233–234.) The abnormal ranges obtained during this period at a radar station near Dunstable for $\lambda = 10$ cm were associated with a rapid lapse of water-vapour content above fog. Radiosonde data do not indicate precisely the boundaries of the dry layers, because of the rate of ascent of the balloon and the time-lag in the humidity element.

621.396.812.029.62 **3240**

U.H.F. Propagation Characteristics.—E. W. Allen, Jr. (*Electronics*, Aug. 1949, Vol. 22, No. 8, pp. 86–89.) From the results of 13 v.h.f. surveys made by the National Bureau of Standards, correction factors have been determined for expected median field strengths; these corrections are applicable to the F.C.C. ground-wave signal/range charts for frequencies from 63 to 195 Mc/s.

621.396.812.029.64 **3241**

Microwave Phase Front Measurements for Over-water Paths of 12 and 32 Miles.—A. W. Straiton. (*Proc. Inst. Radio Engrs, W. & E.*, July 1949, Vol. 37, No. 7, pp. 808–813.) Continuous curves of phase and signal strength at a wavelength of 3.2 cm are shown for a range of transmitter and receiver heights from 10 ft to 55 ft above mean sea level. The results for the two paths are compared, and deviations from those commonly expected for oversea propagation are noted.

538.566 + 621.396.11 **3242**

Terrestrial Radio Waves. [Book Review]—H. Bremmer. Publishers : Cleaver-Hume Press, London, 344 pp., 36s. (*Wireless Engr*, Aug. 1949, Vol. 26, No. 311, pp. 275–276.) The book is based on researches of the author originating in classic papers written in collaboration with van der Pol. It will appeal most to the mathematical physicist who can follow the general line of the analysis, but there are sections of direct use to the engineer. " . . . this book will be a mine of information to the few to whom will fall the task of tackling the outstanding problems of propagation theory."

RECEPTION

621.396.62.029.58 **3243**

The Orchestra in Your Home. The TR138.—R. Geffre. (*Toute la Radio*, Sept. 1949, Vol. 16, No. 138, pp. 243–248.) Complete circuit details of a high-fidelity s.w. receiver with ample sensitivity for good reproduction in France of transmissions from the U.S.A. Special features of the various stages are discussed.

621.396.621 **3244**

A High-Performance Dual-Conversion Superhet.—R. C. Cheek. (*CQ*, July 1949, Vol. 5, No. 7, pp. 16–23 . . 77.) Complete details of a receiver which operates directly from the aerial on 3.5 and 7 Mc/s, but which is preceded by a h.f. converter when operating on 14, 21, 27 or 28 Mc/s. Alignment procedure is described.

621.396.621 **3245**

Philips Model 681A.—(*Wireless World*, Aug. 1949, Vol. 55, No. 8, pp. 289–290.) Test report. Normal tuning is provided in a superheterodyne circuit for wavelength ranges 11.1–34.2 m, 34.2–110.5 m, 192–560 m and 900–2 000 m. There are also 8 selected s.w. broadcast bands of width about 0.5 Mc/s, centred at wavelengths 11, 13, 16, 19, 25, 31, 41 and 49 m, for which a double superheterodyne principle is used in the bandspread circuits, so that the local oscillator on each band works at a fixed frequency and is thus easier to stabilize.

621.396.621 : 621.396.619.13 **3246**

The Demodulation of a Frequency-Modulated Carrier and Random Noise by a Discriminator.—N. M. Blachman. (*Proc. Inst. Radio Engrs, W. & E.*, Aug. 1949, Vol. 37, No. 8, p. 895.) Summary only. See also 1772 of June.

621.396.621 : 621.396.65.029.58 **3247**

The Receiving System at Cooling [Kent] **Radio Station.**—C. F. Booth. (*P.O. elect. Engrs' J.*, July 1949, Vol. 42, Part 2, pp. 84–89.) The factors limiting the performance of long-distance R/T links operating in the frequency range 3 to 30 Mc/s are outlined with particular reference to the downcoming angle at the receiver. The receiver system described uses a highly directive steerable aerial arranged to feed four parallel receiver branches, one of which gives an energy/downcoming-angle diagram on a c.r. tube from which the other three are manually set to three different optimum angles. Performance is compared with that for a receiver having a single aerial; possible future developments of directive receiving systems are considered. The system is similar to the M.U.S.A. system noted in 3016 of 1940 (Polkinghorn).

621.396.823 **3248**

Car-Ignition Interference.—W. Nethercot. (*Wireless Engr*, Aug. 1949, Vol. 26, No. 311, pp. 251–255.) The wide-band continuous radiation from the ignition circuit is due to travelling waves set up in the h.v. cables when the distributor and sparking-plug gaps break down. The current through the sparking-plug gap consists of a series of very steep-fronted steps, the intervals between which are determined by the time the waves take to travel twice the length of the h.v. cables. The envelope of these current steps is oscillatory and its frequency lies between 30 and 50 Mc/s. Resistors at the sparking-plug and distributor terminals should give suppression over the whole frequency band.

621.396.828 **3249**

Goniometer Arrangement for the Suppression of Interfering Transmissions by means of Angle Measurement with Beam-Aerial Systems.—H. Fricke. (*Fernmeldetech. Z.*, Aug. 1949, Vol. 2, No. 8, pp. 249–253.) Two aerials, whose beams are directed towards the wanted station, are connected to the two stator coils of the goniometer, a phase-shifter being interposed between aerial and coil in one case. The receiver is connected to the goniometer search coil. With suitable adjustment of the phase-shifter and of the position of the search coil, signals from an unwanted transmitter operating on the same wavelength as that of the wanted station can be completely eliminated.

STATIONS AND COMMUNICATION SYSTEMS

621.39 : 061.053 **3250**

The Third Session of the Administrative Council of the International Telecommunications Union (I.T.U.) [Geneva, 1948].—G. Gneme. (*Poste e Telecomunicazioni*, Nov. 1948, Vol. 16, No. 11, Supplement, pp. 26–34.)

621.395.44 : 621.396.619.2 **3251**

A 48-Channel Carrier Telephone System: Part 2—Mechanical Construction.—G. H. Bast, D. Goedhart & J. F. Schouten. (*Philips tech. Rev.*, June 1949, Vol. 10, No. 12, pp. 353–358.) Part 1 : 2356 of 1948.

621.396 **3252**

Modern Tendencies in Commercial Long-Distance Radio Communications.—A. Niutta. (*Poste e Telecomunicazioni*, June/July 1948, Vol. 16, Nos. 6/7, pp. 241–251.) A review covering single-sideband transmission, frequency-shift keying and multiplex teleprinter systems.

621.396 : 061.3 **3253**

The Fifth Meeting of the C.C.I.R. [Stockholm, July 1948].—T. Gorio. (*Poste e Telecomunicazioni*, Dec. 1948, Vol. 16, No. 12, pp. 493–502.)

621.396.1 **3254**

The European Broadcasting Conference at Copenhagen [1948].—G. Gneme. (*Poste e Telecomunicazioni*, Nov. 1948, Vol. 16, No. 11, Supplement, pp. 1–16.) Detailed report, with special consideration of the position of Italy.

621.396.1 **3255**

The Copenhagen Maritime Regional Radiocommunication Conference [1948].—G. Gneme. (*Poste e Telecomunicazioni*, Nov. 1948, Vol. 16, No. 11, Supplement, pp. 17–25.) Full details on allocations to coastal stations and to ships.

621.396.61.029.54 : 621.396.712 **3256**

B.B.C. Transmitting Station at Postwick Grange.—(*Engineer, Lond.*, 15th July 1949, Vol. 188, No. 4877, p. 77.) Further details of the new station near Norwich. The aerial system consists of two 126-ft tubular masts spaced $\lambda/4$ apart. The easterly mast is energized; the resulting directional system brings Yarmouth within the service area. See also 2942 of October.

621.396.619.11/.13 **3257**

F.M. *vs* A.M.—D. J. Braak. (*Electronics*, Aug. 1949, Vol. 22, No. 8, pp. 218, 220.) Comment on some of the statements made in the paper abstracted in 1504 of May (Toth).

621.396.619.16 : 621.396.41 **3258**

A Time-Division Multiplexing System.—W. P. Boothroyd & E. M. Creamer, Jr. (*Elect. Engng, N.Y.*, July 1949, Vol. 68, No. 7, pp. 583–588.) A system using pulse-amplitude modulation with a filtering arrangement for minimizing the required transmission bandwidth.

621.396.65.029.58 : 621.396.621 **3259**

The Receiving System at Cooling [Kent] **Radio Station.**—Booth. (*See* 3247.)

621.396.931 **3260**

Portable F.M. Equipment.—H. V. Carlson. (*FM-TV*, July 1949, Vol. 9, No. 7, pp. 14–16.) Description of a unit weighing <10 lb, which operates at a fixed frequency in the range 25–50 Mc/s or 152–165 Mc/s and provides 2-way communication over distances of several miles under noisy conditions.

621.396.931 **3261**

A 28-Mc/s Installation for the Car.—G. P. McGinnis. (*QST*, Aug. 1949, Vol. 33, No. 8, pp. 11–16.) Construction and installation details for amateur equipment which does no damage to the car and only requires an input of 17 W.

621.396.932 **3262**

Automatic Station Call Selector.—W. W. McGoffin & H. R. Schulz. (*Electronics*, Aug. 1949, Vol. 22, No. 8, pp. 75–77.) An instrument which sounds an alarm at a radio station when its own call letters are received at any sending speed from 6 to 34 words/min.

SUBSIDIARY APPARATUS

621.314.58 **3263**

Thyratron Replaces Vibrator.—(*Electronics*, Aug. 1949, Vol. 22, No. 8, pp. 140..144.) Description, with circuit diagram, of a simple d.c./a.c. converter which operates from a 6-V battery and has no moving parts.

621.316.722 : 621.396.682 **3264**

Pre-Calculation of Magnetic Voltage Stabilizers.—W. Taeger. (*Funk u. Ton*, Aug. 1949, Vol. 3, No. 8, pp. 429–437.) Design procedure, with numerical calculations for an output power of 75 W at 220 V. With mains voltage variations from 160 V to 260 V, the stabilized voltage only varied from 215 V to 224 V, in good agreement with theory.

621.316.726 **3265**

Frequency Correction of Electric Signalling Power Supplies.—E. Friedlander & R. A. Duncan. (*G.E.C. J.*, July 1949, Vol. 16, No. 3, pp. 130–137.) Detailed description of the equipment noted in 2054 of July, with particular reference to special features such as the frequency relay and protective devices for tripping in case of hunting or failure to correct the frequency. The frequency relay is based on the principle of phase change in a resonant circuit; its construction and operation are clearly explained.

621.396.68 : 539.16.08 **3266**

Miniature Counter-Tube Power Supply.—D. L. Collins. (*Electronics*, Aug. 1949, Vol. 22, No. 8, pp. 170–173.) The high voltage is obtained across a miniature transformer in a blocking-oscillator circuit using a 1V5 valve. The oscillator pulses are rectified by a low-power h.v. half-wave VX-21 rectifier. Regulation is obtained by means of a 900-V corona voltage regulator.

621.396.682 **3267**

30-kV D.C. Regulated Power Supply.—W. Spellman. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, May 1949, Vol. 12, No. 5, pp. 16–17, 30.) Circuit diagram, without component values, of a supply unit giving an output from 25 to 30 kV; regulation is within 1% under load variations from zero to 1 mA and line-voltage variations from 95 to 125 V.

621.396.682 : 621.316.722.1 **3268**

An Electromechanically Stabilised Mains Supply Unit.—A. E. Maine. (*Electronic Engng*, Sept. 1949, Vol. 21, No. 259, pp. 319–321.) A neon-valve bridge and a voltage-sensing circuit with gas triodes are used to control a bi-directional motor which adjusts the tappings on a variable-ratio transformer, thus correcting any deviation from the required voltage. The output voltage is regulated within 1% for loads up to 1.5 kVA and for voltage deviations of − 15% to + 5%.

621.314.632 **3269**

Metal Rectifiers. [Book Review]—H. K. Henisch. Publishers: Oxford University Press, 168 pp., 15s. (*Electronic Engng*, June 1949, Vol. 21, No. 256, p. 229.) The book will be useful both to students as an introduction to electronic properties of solids and to practical users of dry rectifiers who require a critical but compact account of the subject. The book contains no difficult mathematics.

TELEVISION AND PHOTOTELEGRAPHY

621.397.331.2 **3270**

Slow-Electron Television Cameras.—J. J. M. Moral. (*Rev. Telecomunicación, Madrid*, June 1948, Vol. 3, No. 12, pp. 38–52.) Operating principles and characteristics of the iconoscope, orthicon and isoscope tubes.

621.397.331.2 **3271**

Distortion of Scanning Waveforms.—G. G. Gouriet. (*Electronic Engng*, Sept. 1949, Vol. 21, No. 259, pp. 327–331.) Requirements for a linear scan are discussed. The distortion due to insufficient bass response and means of correcting this distortion are also considered.

621.397.5 **3272**

Televising Moving Images.—R. W. Hallows. (*Wireless World*, Aug. 1949, Vol. 55, No. 8, pp. 291–293.) Calculations of balanced definition for moving images should not be based entirely on data for still images, since moving images introduce many new problems. The greatest immediate need is for developing methods of producing wide-band transmitting and receiving apparatus at reasonable cost.

621.397.5 : 535.88 **3273**

Three-Dimensional Picture Screens for Television and the Cinema.—E. G. Beard. (*Proc. Instn Radio Engrs, Aust.*, June 1948, Vol. 9, No. 6, pp. 4–16.) Previous attempts to produce 3-dimensional pictures on a flat screen are discussed and a practical screen is described. Manufacturing tolerances and the modifications necessary to adapt this screen for use in cinema theatres are considered. An experimental screen gave promising results.

621.397.5 : 535.88 **3274**

A Projection System for Domestic Television Receivers.—(*Electronic Engng*, Sept. 1949, Vol. 21, No. 259, pp. 314–318.) Discussion of a Mullard folded-Schmidt system giving adequate resolution for picture sizes up to 15 in by 12 in, which can be used in conjunction with most existing receiver chassis. See also 2387 of 1948 (Rinia et al.).

621.397.5 : 535.88 **3275**

Home Projection Television: Parts 1-3.—H. Rinia, J. de Gier & P. M. van Alphen; G. J. Siezen & F. Kerkhof; J. Haantjes & F. Kerkhof. (*Proc. Instn Radio Engrs, Aust.*, Aug. 1948, Vol. 9, No. 8, pp. 9–18.) Abridged version of 2387 of 1948.

621.397.5 : 617 **3276**

Television as an Aid to Teaching Operative Surgery.—(*Electronic Engng*, June 1949, Vol. 21, No. 256, pp. 212–213.) Short description of specially designed equipment installed in Guy's Hospital, London, which enables the progress of operations to be followed by many observers without crowding the operating theatre. At present four viewing sets with 15-in screens are used.

621.397.6 : 621.385.832 **3277**

High-Power Cathode-Ray Tubes.—Moss. (*See* 3308.)

621.397.6 : 621.395.625 **3278**

Television Recording: Simplified System.—D. A. Smith. (*Wireless World*, Aug. 1949, Vol. 55, No. 8, pp. 305–306.) An economical system using a television receiver and a 16-mm film projector modified for use as a camera and sound recorder. Of every three television frames, two consecutive ones are photographed and the third is missed. A recording lamp for the sound signal is fed from the receiver output valve. For reproduction a standard projector with a 3-bladed shutter and running at 16 frames/sec can be used.

621.397.6 : 621.396.615.17 : 621.317.755 **3279**

Television Time Base Linearisation.—Keen. (*See* 3098.)

621.397.62 **3280**

Television Receiver with Rimlock Valves and Automatic Frequency and Phase Control.—F. Juster. (*Radio prof., Paris*, June 1949, Vol. 18, No. 174, pp. 11–15.) Complete circuit and component details for a receiver with an MW31-7 c.r. tube.

621.397.62 **3281**

Designing a T.R.F. [tuned radio frequency] **Television Receiver.**—W. H. Buchsbaum. (*Tele-Tech*, Aug. 1949, Vol. 8, No. 8, pp. 36–39.) The 15-valve receiver uses three metal rectifiers in 'B' supply and operates from a.c. or d.c. A 2-valve r.f. amplifier and a four-stage video amplifier give high gain and performance nearly equal to those of superheterodyne receivers. Advantages and limitations of this type of receiver are discussed.

621.397.62 **3282**

Transit-Time Effects in Television Front-End Design.—Watts. (*See* 3113.)

621.397.645 **3283**

Television Stabilizing Amplifier.—Schultz. (*See* 3114.)

621.397.7 **3284**

The Television Studio.—D. C. Birkinshaw. (*B.B.C. Quart.*, July 1949, Vol. 4, No. 2, pp. 105–117.) An account of studio technique used at the London television station, Alexandra Palace.

621.397.828 **3285**

Television Interference Suppression.—"Spenny". (*R.S.G.B. Bull.*, Aug. 1949, Vol. 25, No. 2, p. 44.) Suppression of a 90-Mc/s harmonic from an amateur transmitter was effected by shunting the output by means of a $\lambda/2$ line.

621.397.828 **3286**

TVI Reduction — Western Style.—C. E. Murdock. (*QST*, Aug. 1949, Vol. 33, No. 8, pp. 24–27, 82.) Interference caused by the harmonics of a 1-kW amateur transmitter 40 ft away from a television receiver was reduced by using high-capacitance tank circuits in the anode of the driver valve and single-turn coaxial pickup loops and high-capacitance grid circuits in the final amplifier. Aerial tuners were also built for each amateur band. Methods of suppressing interference due to line voltage fluctuations and keying clicks are also discussed.

621.397.828 **3287**

The H.R.O. and T.V.I.—R. L. Varney. (*R.S.G.B. Bull.*, Aug. 1949, Vol. 25, No. 2, pp. 41–42.) A strong third harmonic at the television frequency of 45 Mc/s is produced by the first heterodyne oscillator of the H.R.O. communications receiver when operating in the 14-Mc/s band. This is suppressed by connecting a series-resonant circuit between the oscillator valve cathode and earth.

TRANSMISSION

621.396.61 **3288**

A New 150-kW A.M. Transmitter.—T. J. Boerner. (*Broadcast News*, June 1949, No. 55, pp. 42–49.) An efficient compact transmitter for the frequency range 540–1 600 kc/s, using class-B modulation of a class-C final amplifier. Details of design, layout and installation are given and the results of performance tests are shown graphically and tabulated.

621.396.61 **3289**

The Types TGM.651 and TGZ.651 Transmitters.—W. J. Morcom. (*Marconi Rev.*, July/Sept. 1949, Vol. 12, No. 94, pp. 104–107.) Type TGM.651 is a 3-kW m.f. transmitter, and Type TGZ.651 a 3-kW m.f. and l.f. transmitter. These complete the series of which other members were noted in 553 of February (Cooper) and 1219 of April.

621.396.61 : 621.392.52 **3290**

A Filter Design for the Single-Sideband Transmitter.—F. M. Berry. (*QST*, June 1949, Vol. 33, No. 6, pp. 29–35.) A highly selective first i.f. bandpass filter. Sharp cut-off is restricted to the h.f. side of the pass band which extends from 17 to 20 kc/s. Basic design formulae are given for the filter which consists of two combined m-derived π sections. Modifications permit operation directly from a ring modulator into the grids of a balanced valve modulator. The filter can be aligned with the minimum of special equipment.

621.396.61 : 621.396.8 **3291**

Operation of A.M. Broadcast Transmitters into Sharply Tuned Antenna Systems.—W. H. Doherty. (*Proc. Inst. Radio Engrs, W. & E.*, July 1949, Vol. 37, No. 7, pp. 729–734.) Investigation of the clipping of sidebands and distortion of the voltage envelope at high modulation frequencies. The effects may be reduced by suitable coupling methods.

621.396.61 : 621.396.97 **3292**

The New 100-kW [broadcasting] **Transmitter at Naples.**—S. Bertolotti. (*Poste e Telecomunicazioni*, Jan. 1949, Vol. 17, No. 1, pp. 44–46.) Distortion at 100% modulation is within 2%, the frequency curve is linear to within 2 db up to 10 000 c/s, and background noise is at least 60 db down. Overall efficiency is 39%.

621.396.619.23 **3293**

A High Voltage Ring Modulator.—M. J. Tucker. (*Electronic Engng*, July 1949, Vol. 21, No. 257, pp. 239–242.) A form of biased ring modulator using diodes provides a satisfactory precision 'phase-conscious' rectifier for use at voltages high enough to enable the output to be applied directly to the grid of an output stage. Practical circuits are discussed. See also 3542 and 3543 of 1948 (D. G. Tucker).

VALVES AND THERMIONICS

537.291 **3294**

Control of a Beam of Electrons by an Intersecting Electron Beam.—J. L. H. Jonker & A. J. W. M. van Overbeek. (*Nature, Lond.*, 13th Aug. 1949, Vol. 164, No. 4163, pp. 276–277.) Two electrode systems are arranged to produce two mutually perpendicular electron beams. The voltage applied to grid 1 determines the current in beam 1; this in turn controls the current in beam 2. A graph of the voltage of grid 1 against current to anode 2 is shown. The slope of this curve is more than twice that obtainable with normal direct grid control. It is suggested that replacing anode 2 by a secondary-emission multiplier would result in a slope of several amperes per volt at currents of the order of 10^{-2} A.

537.291 + 538.691] : 537.525.92 **3295**

Electron Flow in Curved Paths under Space-Charge Conditions.—Meltzer. (*See* 3120.)

621.383 **3296**

On a Method for the Production of Photo-Sensitive Layers of Very High Resistance with PbS as Infra-Red-Sensitive Semiconductor.—K. Frank & K. Raithel. (*Z. Phys.*, 27th May 1949, Vol. 126, No. 5, pp. 377–382.) The layers are produced by vaporization of PbO in an atmosphere of sulphur vapour at low pressure, with subsequent heat treatment. Resistance is of the order of 10^{11}–10^{12} Ω cm. The results of an investigation of such films by electron diffraction methods are discussed.

621.383 : 621.385.15 **3297**

Electron-Multiplier Tubes. Developments. Use.—A. Lallemand. (*J. Phys. Radium*, July/Sept. 1949, Vol. 10, Nos. 7/9, pp. 235–239.) The fluctuation of the output current is determined for the ideal electron multiplier as a function of the number of stages and of the multiplication factor per stage. Other causes of current fluctuation are considered and a tube designed to eliminate such fluctuations as far as possible is described. The use of multiplier tubes with a very stable symmetrical amplifier, and also in a simple circuit including a neon lamp shunted by a capacitor, is discussed.

621.383 : 621.385.15 : 621.396.822 **3298**

On the Variation of the Background Noise of a Photomultiplier RCA 931A with the Potential of the Glass Envelope.—C. Taylor. (*J. Phys. Radium*, July/Sept. 1949, Vol. 10, Nos. 7/9, pp. 255–256.) The background noise is multiplied by about 10 when the potential of the envelope differs from that of the photocathode by − 500 V or + 1 000 V. A theory of the effect is proposed. For applications requiring low background noise, such as the counting of particles by scintillations, the envelope should be maintained at the potential of the photocathode.

621.383.4 **3299**

Lead Sulfide Photoconductive Cells.—S. Pakswer. (*Electronics*, Aug. 1949, Vol. 22, No. 8, pp. 216, 218.) Correction to 2370 of August.

621.385 **3300**

The Electron Wave Tube.—A. V. Haeff. (*Proc. Inst. Radio Engrs, W. & E.*, July 1949, Vol. 37, No. 7, pp. 777–778.) Discussion on 1825 of June.

621.385 **3301**

The Development of Radio Transmitting Valves.—J. Bell & J. W. Davies. (*G.E.C. J.*, July 1949, Vol. 16, No. 3, pp. 138–149.) The limitations of early types are discussed. New construction and manufacturing techniques which have largely overcome these limitations are described. Typical valves are illustrated and their ratings and performance are tabulated.

621.385.032.29 **3302**

The Calculation of the Electrode Temperatures in Radio Valves.—S. Wagener: I. A. Harris. (*J. Brit. Instn Radio Engrs*, Aug. 1949, Vol. 9, No. 8, pp. 318–319.) Comment on 1232 of April (Harris) and the author's reply.

621.385.3 : 621.396.645.029.3 **3303**

A Low-Noise [audio] **Input Tube.**—C. R. Knight & A. P. Haase. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, March 1949, Vol. 12, No. 3, pp. 15–18, 31.) Description of the double triode 12AY7, in which microphony effects and other noises are particularly low. A balanced amplifier, using these valves in the first two stages and a 12AU7 in the output stage, with cross neutralization and inverse feedback, is also described and a detailed circuit diagram is given. The response curve is essentially flat from 30 c/s to 20 kc/s.

621.385.38 : 621.317.3 **3304**

The Deionization Time of Thyratrons: A New Method of Measurement.—Knight. (*See* 3186.)

621.385.832 **3305**

Projective Three-Dimensional Displays: Parts 1 & 2.—D. M. MacKay. (*Electronic Engng*, July & Aug. 1949, Vol. 21, Nos. 257 & 258, pp. 249–254 & 281–286.) A circuit is discussed which will perform two stages of rotation, one about the Y axis moving X to X′, and the second about the X′ axis. These rotations remove any structural ambiguities present in a given projection. Three methods of obtaining perspective convergence are given. A stereoscopic switching unit and various methods for the relative measurement of projections are described. See also 577 of February (Parker & Wallis) and 1242 of April (Berkley).

621.385.832 : 535.371.07 **3306**

The Physics of Cathode Ray Tube Screens.—Garlick. (*See* 3158.)

621.385.832 : 621.396.9 **3307**

Three-Dimensional Cathode-Ray Tube Displays.—E. Parker & P. R. Wallis. (*Proc. Instn elect. Engrs*, Part III, July 1949, Vol. 96, No. 42, pp. 291–294.) Discussion on 577 of February.

621.385.832 : 621.397.6 **3308**

High-Power Cathode-Ray Tubes.—H. Moss. (*Wireless Engr*, Sept. 1949, Vol. 26, No. 312, pp. 293–296.) A preliminary survey of the design of tubes with screen diameters up to 30 in for direct viewing. The relation between the response of cascade screens and the beam voltage is uncertain and is of critical importance. Mechanical design difficulties are briefly discussed.

621.396.615.141.2 **3309**

The Cavity Magnetron.—H. A. H. Boot & J. T. Randall. (*Proc. Instn elect. Engrs*, Part III, July 1949, Vol. 96, No. 42, pp. 261–263.) Discussion on 890 of 1948.

621.396.822 **3310**

Valve Noise and Transit Time.—C. J. Bakker. (*Wireless Engr*, Aug. 1949, Vol. 26, No. 311, p. 277.) Comment on 2420 of 1948 (Campbell, Francis & James). See also 255 of January, 583 of February (Houlding), and 3311 below.

621.396.822 **3311**

Measurement of Induced Grid Noise.—F. L. H. M. Stumpers. (*Wireless Engr*, Aug. 1949, Vol. 26, No. 311, pp. 277–278.) Discussion of recent experimental results which agree with those discussed by Bakker (3310 above and back references).

621.396.822 **3312**

Transit-Time Effects in U.H.F. Valves.—J. Thomson. (*Wireless Engr*, June 1949, Vol. 26, No. 309, pp. 192–199; corrections *ibid.*, Aug. 1949, Vol. 26, No. 311, p. 278.) Mathematical technique suitable for cases such as total-emission damping, where space-charge distortion of the e.s. field can be neglected. See also 3313 below.

621.396.822 **3313**

Transit-Time Effects in U.H.F. Valves.—R. E. Burgess: J. Thomson. (*Wireless Engr*, Sept. 1949, Vol. 26, No. 312, p. 313.) Burgess suggests that Bakker & de Vries (3374 of 1935) covered much of the work noted in 3312 above. Thomson regards their work as valid only for a simple idealization.

MISCELLANEOUS

621.39 **3314**

Wheeler Monographs.—A series of monographs appearing at two-monthly intervals, available on a subscription basis from Wheeler Laboratories Inc., 122, Cutter Mill Road, Great Neck, N.Y., U.S.A. Single copies of each issue cost $25.00. All the monographs are by H. A. Wheeler except where otherwise stated. Titles of the first 11 monographs are :—1. Transmission Lines and Equivalent Networks. 2. Slide Rule Operations for Radio Problems. 3. A Simple Theory and Design Formulas for Superregenerative Receivers. 4. Geometric Relations in Circle Diagrams of Transmission-Line Impedance. 5. Generalized Transformer Concepts for Feedback Amplifiers and Filter Networks. 6. A Simple Theory of Powdered Iron at all Frequencies. 7. Superselectivity in a Superregenerative Receiver. 8. The Piston Attenuator in a Waveguide below Cut-off. 9. Measuring the Efficiency of a Superheterodyne Converter by the Input Impedance Circle Diagram, by H. A. Wheeler & D. Dettinger. 10. The Transmission Efficiency of Linear Networks and Frequency Changers. 11. The Maximum Speed of Amplification of a Wide-Band Amplifier.

621.396 Popov **3315**

Alexander S. Popov.—G. W. O. H. (*Wireless Engr*, Aug. 1949, Vol. 26, No. 311, pp. 249–250.) Reply to comment by Thornton (2113 of July) on 1842 of 1948.

652.6 **3316**

Directory of Translators.—(*J. Franklin Inst.*, July 1949, Vol. 248, No. 1, p. 104.) A directory of language specialists competent in various technical fields has been established by the Science-Technology Group of Special Libraries Association under the management of Mr. W. Kalenich, Librarian at the Southwestern Research Institute, San Antonio, Texas. About 3 000 technical translations already available in private files have also been listed.

621.396 (031) **3317**

The Radio [amateur's] **Handbook (Le Manuel Radio). French Edition.** [Book Review]—Headquarters Staff of the American Radio Relay League. Publishers: P. H. Brans, Antwerp, 1948, 350 pp., 240 fr. (Belgian). (*Alta Frequenza*, April 1949, Vol. 18, No. 2, p. 88.) See also 2682 of September.

681.2 **3318**

The Instrument Manual. [Book Review]—Publishers: United Trade Press, London, 548 pp., 70s. (*Electronic Engng*, Aug. 1949, Vol. 21, No. 258, p. 310.) The book covers a very wide field. The majority of instruments and control gear described are mechanical, although electronic devices are not ignored. The text is in simple descriptive language, and many illustrative diagrams are given.

ABSTRACTS and REFERENCES

Compiled by the Radio Research Board and published by arrangement with the Department of Scientific and Industrial Research

The abstracts are classified in accordance with the Universal Decimal Classification. They are arranged within broad subject sections in the order of the U.D.C. numbers, except that notices of book reviews are placed at the ends of the sections. U.D.C. numbers marked with a dagger (†) must be regarded as provisional. The abbreviations of the titles of journals are taken from the World List of Scientific Periodicals. Titles that do not appear in this List are abbreviated in a style conforming to it.

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ACOUSTICS AND AUDIO FREQUENCIES

53.081.4 **3319**

A New Frequency Scale for Acoustic Measurements.—W. Koenig. (*Bell Lab. Rec.*, Aug. 1949, Vol. 27, No. 8, pp. 299–301.) A scale which is linear up to 1 000 c/s and logarithmic above 1 000 c/s, with smooth transition at 1 000 c/s.

534.143 **3320**

On the Principal Possibilities of Electroacoustic Energy Transformation and its Classification.—F. A. Fischer. (*Arch. elekt. Übertragung*, July 1949, Vol. 3, No. 4, pp. 129–135.) The electrodynamic theory of quasistationary fields gives six fundamentally different possible methods of transforming electrical into mechanical energy in noncrystalline media, three electrical and three magnetic. These are discussed.

534.321.9 **3321**

Electric-Field Modulation of Ultrasonic Signals in Liquids.—A. W. Nolle. (*J. appl. Phys.*, June 1949, Vol. 20, No. 6, pp. 589–592.) An experiment to determine (*a*) whether the presence of a periodic transverse electric field produces modulation of the amplitude or phase of a continuous progressive ultrasonic wave train passing through a liquid, (*b*) whether the application of an electric field to a polar liquid affects either the compressibility or the viscosity of the liquid through molecular orientation. Phase modulation was observed in some conducting liquids. Amplitude modulation was not found in any liquid. See also 3002 of November (Bonetti).

534.321.9 : 534.373 **3322**

Ultrasonic Absorption in Water in the Region of 1 Mc/s.—C. E. Mulders. (*Nature, Lond.*, 27th Aug. 1949, Vol. 164, No. 4165, pp. 347–348.) The absorption (of the order of 0.2 db/m) is calculated, by a formula taking friction and radiation into account, from the reverberation time of a smooth aluminium vessel filled with boiled distilled water. See also 932 of April.

534.4 **3323**

The Analysis and Synthesis of Musical Sounds.—A. W. Ladner. (*Electronic Engng*, Oct. 1949, Vol. 21, No. 260, pp. 379–386.) The synthesis of complex sustained musical tones by means of a series of harmonics is much more difficult than the synthesis of musical transients. This is probably because the waves produced by a musical instrument are not all exactly alike; the second-order amplitude and frequency differences cause a frequency spread which is not revealed by present methods of harmonic analysis. Sounds should therefore be examined also for frequency changes by frequency-discriminating circuits. An acoustical harmonic synthesiser is described.

534.6 + 534.8 **3324**

Work of the Laboratory of Technical Acoustics [Copenhagen]**, 1941-1946.**—F. Ingerslev & K. Nielsen. (*Ingen-Vidensk. Skr.*, 1947, No. 2, 128 pp. In Danish.) An account of some of the apparatus and methods of measurement developed since the formation of the Laboratory. The lay-out of lagged and reverberation rooms is described. Determinations of the radiation pressure, intensity and frequency spectrum of sound in air, measurement of mechanical vibrations in structures, of reverberation times as functions of frequency and of the distribution of sound in enclosed spaces, determination of sound-absorption coefficients by the tube and sound-chamber methods, insulation against airborne sound and reduction of foot-fall noise in buildings, are discussed. On the electroacoustics side, the measurements described concern principally the frequency and directional characteristics of microphones and loudspeakers. Special attention has been paid by the Laboratory to the measurement of sound-absorption coefficients and details are given of an improved selective amplifier for use with the tube method.

534.61 : 534.75 **3325**

On a New Audiometer.—G. von Békésy. (*Arch. elekt. Übertragung*, July/Aug. 1947, Vol. 1, Nos. 1/2, pp. 13–16.) The slider of a potentiometer determining the intensity of the tone provided by an a.f. signal generator is operated by a motor whose rotation in either direction can be controlled by the person whose hearing is to be tested. Intensity is adjusted until a particular tone is inaudible and readjusted until the tone is again audible, the movement of the potentiometer slider being recorded on a drum. This drum is coupled to a variable capacitor by means of which the generator frequency is varied between the limits of 100 c/s and 15 kc/s. The whole frequency range is covered slowly to obtain a zigzag record on the drum. The potentiometer is designed to give intensity steps of 2 db, so that the record is direct-reading for both intensity and frequency. Typical records for hard-of-hearing subjects are given.

534.833.1 **3326**

Transmission of Reverberant Sound through Single Walls.—A. London. (*Bur. Stand. J. Res.*, June 1949, Vol. 42, No. 6, pp. 605–615.) Random-incidence sound-transmission measurements were made on homogeneous walls of plywood and plasterboard. Results were in satisfactory agreement with a modified version of Cremer's theory (1446 of 1943) which postulates that the wall impedance has a resistive component as well as its mass reactance and a stiffness reactance due to flexural waves. The resistance and critical flexure frequency are determined from the experimental data so as to obtain the best fit between theoretical and experimental results; the transmission loss is deduced. The validity of the mass law of sound transmission is discussed. An increase in transmission loss can be obtained by applying a fairly substantial sound-absorbent blanket to the back of a homogeneous wall.

621.395.61/.62 : 546.431.82 **3327**

Barium-Titanate Ceramic as an Electromechanical Transducer.—Mason. (*See* 3439.)

621.395.625.2 **3328**

Considerations on Disk Recording and Reproduction.—P. H. Werner. (*Tech. Mitt. schweiz. Telegr.-TelephVerw.*, 1st Aug. 1949, Vol. 27, No. 4, pp. 168–178. In French and German.) Detailed discussion of the 'Technical Standards and Good Engineering Practices of the National Association of Broadcasters for Electrical Transcriptions and Recording for Radio Broadcasting'. This publication was noted in 458 of 1943.

621.395.625.3 **3329**

Magnetic Recording Technique.—D. Roe. (*Wireless World*, Oct. 1949, Vol. 55, No. 10, pp. 362–364.) Practical notes for the experimenter. See also 3889 of 1944 (Aldous: Ashman) and 2463 of 1946 (Power).

621.395.625.3 **3330**

Magnetic-Tape Recorder.—(*Engineer, Lond.*, 19th Aug. 1949, Vol. 188, No. 4882, pp. 198–199.) A high-fidelity speech and music recorder made by the General Electric Co., London. Its 1 000 yd of coated plastic tape give a recording or playback time of 80 min. The fitting of separate recording, playing and erasing heads enables continuous monitoring of the recorded programme to be carried out.

681.85 : 531.7 **3331**

Compliance Meter for Pickups.—A. M. Wiggins. (*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 94–95.) The stylus point is placed in a V-groove in the edge of a vibrating reed on which is cemented a piezoelectric ceramic strip whose output voltage is measured.

621.395.625.3 **3332**

Magnetic Recording. [Book Review]—S. J. Begun. Publishers: Murray Hill Books, New York, 1949, 242 pp., $5.00. (*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 248, 250.) A book that reviews "the subject up to date, separates the chaff from the wheat in the literature and presents an authoritative discussion of the art. . . . an unusually readable and well organized text."

AERIALS AND TRANSMISSION LINES

621.3.09 **3333**

Calculation of the Impedance and Attenuation of High-Frequency Lines from the Field of a Perfect Conductor.—H. Buchholz. (*Arch. Elektrotech.*, Sept. & Dec. 1948, Vol. 39, Nos. 2/3 & 4, pp. 79–100 & 202–215.)

621.315.221 : 538.541 **3334**

Electromagnetic Eddy-Current Fields of Spiral Form.—P. Jacottet. (*Arch. Elektrotech.*, June 1948, Vol. 39, No. 1, pp. 8–26.) Calculation of the effects produced in a cable sheath of finite thickness by alternating currents in a twisted pair of conductors.

621.392.26† **3335**

Contributions to the Theory of Waveguides: Parts 1-4.—L. Infeld, A. F. Stevenson & J. L. Synge; A. F. Stevenson; W. Z. Chien; L. Infeld. (*Canad. J. Res.*, July 1949, Vol. 27, Sec. A, No. 4, pp. 69–129.) Part 1: "Radiation from a Source inside a Perfectly Conducting Wave Guide of Rectangular Section." The field inside a semi-infinite rectangular waveguide closed at one end by a plug is determined, the current distribution in the source being regarded as known. The walls of the guide and the plug are regarded as perfectly conducting. Three different methods of solution are given. The radiation resistance is then deduced from energy considerations. In particular, an expression is derived for the radiation resistance of a linear aerial perpendicular to the wider face of the plug, fed at the point of entry. It is assumed that the aerial current is sinusoidal and that only the fundamental H-wave is transmitted by the guide.

Part 2: "A General Method for Calculating the Impedance of an Antenna in a Wave Guide of Arbitrary Cross Section." One of the methods of part 1 is extended to the case of a guide of arbitrary cross-section. The general problem of calculating radiation resistance and reactance is discussed.

Part 3: "The Resistances of Antennae of Various Shapes and Positions in Rectangular and Circular Wave Guides." Formulae are given for aerials with various assumed current distributions.

Part 4: "The Impedance of a Rectangular Wave Guide with a Thin Antenna." Contains explicit calculations for the impedance of a linear aerial in a rectangular waveguide. Appendices by J. R. Pounder and A. F. Stevenson are included.

621.392.26† **3336**

The Duo-Mode Exciter.—W. A. Hughes & M. M. Astrahan. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, p. 1031.) A device is described for propagating the TE_{10} and TE_{20} modes independently in the same waveguide. The voltage s.w.r. is low over a wide frequency range and there is little crosstalk between inputs. Performance is discussed.

621.392.26† **3337**

Notes on "Wave Guides for Slow Waves".—W. Walkinshaw. (*J. appl. Phys.*, June 1949, Vol. 20, No. 6, pp. 634–635.) Comment on 1584 of June (Brillouin).

621.392.26† : 621.3.09 **3338**

The Transverse Field in Waveguides of Circular Cross-Section.—P. Jacottet. (*Arch. Elektrotech.*, Sept. 1948, Vol. 39, Nos. 2/3, pp. 108–115.) The similarities and differences in the behaviour of the transverse fields of e.m. oscillations of the $E_{m,n}$ and $H_{m,n}$ types are enumerated; they provide a basis for the development of field diagrams and for the classification of the natural oscillations according to wave type and order number. From the equation for the family of curves for the transverse field, the electric field diagram for $H_{m,n}$ waves is calculated and illustrated for the values $m = 1; 2; n = 1; 2$.

621.396.67 **3339**

Microwave Lenses.—C. Susskind. (*Wireless World*, Oct. 1949, Vol. 55, No. 10, pp. 370–372.) A brief general survey of the three main types.

621.396.67 **3340**

Ground Plane Field of the Wide Angle Conical Dipole.—P. D. P. Smith. (*J. appl. Phys.*, June 1949, Vol. 20, No. 6, p. 636.) A formula is deduced from the work noted in 644 of March; assumptions are stated.

621.396.67 **3341**

Comments on Biconical Antennas.—P. D. P. Smith. (*J. appl. Phys.*, June 1949, Vol. 20, No. 6, p. 633.) Reply to comment by Tai (1588 of June) on 644 of March.

621.396.671 **3342**

Impedance Transformation in Folded Dipoles.—R. Guertler. (*J. Brit. Instn Radio Engrs*, Sept. 1949, Vol. 9, No. 9, pp. 344–350.) The impedance of a folded dipole relative to that of a simple dipole can be adjusted by using conductors of different diameters for the separate elements of the folded dipole. Increased impedance ratios can be obtained by using additional elements. The impedance ratio can be obtained from the current ratio; formulae are derived. Practical examples are given. Reprinted from *Proc. Instn Radio Engrs, Aust.*, April 1949.

621.396.671 **3343**

A Study of the E.M.F. Method.—C. T. Tai. (*J. appl. Phys.*, July 1949, Vol. 20, No. 7, pp. 717–723.) The method is applied to the determination of the impedance of a thin biconical aerial as first suggested by Schelkunoff (1049 of 1942). The various components of the currents flowing in the aerial are considered, and the sinusoidal part is shown to predominate. The total current at the end of the aerial, where the lateral surface of the cone and the spherical cap meet, is not identically zero but vanishes with the reciprocal of the square of the characteristic impedance of the cone. The computation of various functions involved is discussed.

621.396.671 **3344**

Some Aids in Sketching Field Strength Diagrams.—F. Duerden. (*Electronic Engng*, Oct. 1949, Vol. 21, No. 260, pp. 375–378.)

621.396.677 **3345**

Dielectric Aerials.—H. Aberdam. (*Télévis. franç.*, Aug. 1949, No. 50, pp. 11–15.) A general survey of their properties, with particular reference to an unpublished paper by O. Zinke. See also 20 of January (Zinke), 1602 of June (Watson & Horton) and 1604 of June (Mallach).

621.396.679.4 : 621.396.931 : 621.396.611.4 **3346**

Cavity Resonators in Mobile Communications.—Magnuski. (*See* 3378.)

CIRCUITS AND CIRCUIT ELEMENTS

621.3.016.352 **3347**

Stability Criterion, particularly for Control Circuits with a Prescribed Degree of Stability.—A. Leonhard. (*Arch. Elektrotech.*, Sept. 1948, Vol. 39, Nos. 2/3, pp. 100–107.) Extension of previous work (567 of 1946) gives an improved stability criterion. In the characteristic equation of the system considered, the variable p is replaced by the value $\omega(j - \rho)$, where $\pi\rho$ is the logarithmic decrement, and ω is varied from 0 to ∞. The characteristic curve is thus derived simply. The behaviour of this curve indicates whether all oscillations exhibit at least a prescribed attenuation, or what oscillations satisfy the required conditions and what do not. In addition, approximate values for a pair of complex roots can be derived from the curve. Practical examples illustrate the application of the method.

621.3.016.352 : 681.142 **3348**

Stabilization of Simultaneous Equation Solvers.—G. A. Korn. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, pp. 1000–1002.) In order to find out whether a number of identical amplifiers can form a stable multiple-loop feedback system for solving simultaneous equations whose coefficients form a positive definite matrix, it is only necessary to test the stability of one such amplifier with simple feedback, when this amplifier is used to solve a single simple equation.

621.314.2 : 629.135 **3349**

Small Power Transformers for Aircraft Electrical Equipments.—A. L. Morris. (*Proc. Instn elect. Engrs*, Part II, June 1949, Vol. 96, No. 51, pp. 413–422. Discussion, pp. 422–425.) The effects of climate and altitude on transformers are discussed. To obtain the smallest possible transformer for a given rating, high-grade magnetic materials should be used for the cores, and high-temperature insulating materials, such as silicone products, should replace purely organic insulating materials. A design for a 500-VA 1 600-c/s transformer is included. Reprinted, *ibid.*, Part III, July 1949, Vol. 96, No. 42, pp. 279–288. Discussion, pp. 288–291.

621.314.3† **3350**

The Theory of Magnetic Amplifiers and some Recent Developments.—E. H. Frost Smith. (*J. sci. Instrum.*, Aug. 1948, Vol. 25, No. 8, pp. 268–272.)

621.314.3 **3351**

An Analysis of Interlinked Electric and Magnetic Networks with Application to Magnetic Amplifiers.—D. W. ver Planck & M. Fishman. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, pp. 1021–1027.) Full paper: summary noted in 2447 of September.

621.314.3† **3352**

The Amplistat—A Magnetic Amplifier.—R. E. Morgan. (*Elect. Engng, N.Y.*, Aug. 1949, Vol. 68, No. 8, pp. 663–667.) The theory of the saturable-core reactor amplifier is briefly outlined. Several typical circuits for single-phase amplistats are given. The effects of the supply voltage and frequency, and of the load impedance, are illustrated by graphs. Amplifications as high as 10^{12} have been obtained with a single stage. Advantages include long life, no starting delay, no moving parts, ruggedness, and quiet operation.

621.316.86 **3353**

Thermistors: Properties and Uses of Negative-Temperature-Coefficient Resistors.—(*Wireless World*, Oct. 1949, Vol. 55, No. 10, pp. 405–407.)

621.316.86 **3354**

Thermistors as Components open Product Design Horizons.—K. P. Dowell. (*Elect. Mfg*, Aug. 1948, Vol. 42, No. 2, pp. 84–91 . . 212. Bibliography, pp. 212 . . 216.) A general discussion of thermistor properties and of various applications. See also 2156 of August (Butler).

621.316.86 : 551.508 **3355**

Thermistors as Instruments of Thermometry and Anemometry.—W. B. Hales. (*Bull. Amer. met. Soc.*, Dec. 1948, Vol. 29, No. 10, pp. 494–499.) For thermometry, the standard current through the Type V-560 thermistor bead is 0.02 mA, which is nearly the maximum for which electrical heating of the bead can be neglected; the change in resistance with changing ambient temperature is detected by a bridge circuit. For anemometry the current varies from 3.8 mA at a temperature of 180°C for zero wind velocity to 0.5 mA at 100°C for a wind velocity of 40 m.p.h. The calibration is little affected by variations in ambient temperature.

621.318.42.011.3 **3356**

Approximate Formulae for Calculation of the Inductance of Circular Coils.—E. Löfgren. (*Rev. gén. Élect.*, Aug. 1949, Vol. 58, No. 8, pp. 305–315.) Examination of the approximate formulae hitherto available shows that none of them give an accuracy within 3% for all the usual forms of coil. To ensure even this accuracy at least four different formulae, depending on the type of coil, are necessary. Starting from known series for the calculation of inductance, a series for the reciprocal of the inductance is derived; this has the advantage that the first terms constitute a first approximation which can be used even outside the limits of convergence of the series. Two alternative inductance formulae with maximum error not exceeding 1% are given. One gives results within 1% even for coils of length or breadth much greater with respect to the mean diameter than is usual in practice. The other formula is simpler, but is limited to coils of normal form. It can, however, be written so as to be applicable to coils whose winding cross-section is not rectangular. A complementary formula for coils of small dimensions is also given, as well as a correction formula taking account of the insulation between turns.

621.318.572 : 539.16.08 **3357**

Electronic Counters for Pulses.—P. Naslin & A. Peuteman. (*Onde élect.*, Aug./Sept. 1949, Vol. 29, Nos. 269/270, pp. 330–335.) Continuation of 2740 of October. A detailed description is given of a counter chronometer constructed by the electromechanics section of the Laboratoire Central de l'Armement. The chronometer comprises a stabilized 100-kc/s oscillator from which pulses of the same frequency are derived, an electronic counter followed by a mechanical counter, and an electronic interrupter which, when closed, connects the oscillator to the counter. The counter includes a binary system of six double-triode flip-flop circuits, a decade system with two thyratron stages, and a 6-disk mechanical counter, giving a total counting time of 64 000 sec for a pulse spacing of 10 μs. Typical measurements with the chronometer are described briefly.

621.318.572 : 621.396.611.4 **3358**

Microwave Secondary-Emission Switch.—(*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 186..190.) A cavity resonator of special shape has a gap whose faces consist of beryllium copper, which has a secondary-emission ratio of 3.5. The electron current in the gap and other operating characteristics are shown as functions of the incident power. The design is due to B.D. Steinberg.

621.319 : 679.5 **3359**

Plastic Electrets are nearing Industrial Application.—T. A. Dickinson. (*Elect. Mfg*, Aug. 1948, Vol. 42, No. 2, pp. 101–103.) Full paper; summary noted in 1307 of May.

621.392 : 621.3.015.3 **3360**

Synthesis of *n*-Reactance Networks for Desired Transient Response.—P. R. Aigrain & E. M. Williams. (*J. appl. Phys.*, June 1949, Vol. 20, No. 6, pp. 597–600.) A method is given for this synthesis in the cases for which the Laplace transform of the input impulse contains either no poles or one pole at $s = 0$. The relation between this method and synthesis techniques based on steady-state considerations is discussed. The method is illustrated for a simple case.

621.392 : 621.317.784 **3361**

Novel Multiplying Circuits with Application to Electronic Wattmeters.—M. A. H. El-Said. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, pp. 1003–1015.) Anode current is exponentially related to anode voltage for a diode operated in the retarding-field region. The development of the corresponding exponential mode of operation of multigrid valves is discussed, for which anode current is accurately proportional to the product of a linear function of anode voltage and an exponential function of grid voltage over wide ranges. Various circuits using a single multigrid valve in this mode of operation are analysed. Accurate compensation for inherent anode rectification due to the curvature of the grid-voltage characteristic is considered. Wattmeters based on this principle have predictable performance over the frequency range 20 c/s to 50 Mc/s, absorb a very small fraction of the measured power, and can be used to measure very small powers.

621.392 : 621.385 **3362**

The Sensitivity Limit of Basic Valve Circuits.—W. Kleen. (*Frequenz*, July 1949, Vol. 3, No. 7, pp. 209–216.) Consideration of grounded-cathode, grounded-grid and grounded-anode circuits shows that for given valves and given input circuits the sensitivity limit for long waves is independent of the particular arrangement used, and nearly independent in the region of finite electron transit times. The question of the coherence or incoherence of noise currents originating from the same source is also discussed.

621.392.015.3 **3363**

On the Optimum Response of a Circuit with Limited Pass Band to a Heaviside Pulse.—J. Laplume. (*C. R. Acad. Sci., Paris*, 1st Aug. 1949, Vol. 229, No. 5, pp. 351–352.) Formulae are derived for the output signal with minimum distortion. Calculation of the spectrum of this output signal then enables the circuit gain to be found.

621.392.4/.5 **3364**

The Synthesis of Passive Two-Poles by means of Networks containing Gyrators.—B. D. H. Tellegen. (*Philips Res. Rep.*, Feb. 1949, Vol. 4, No. 1, pp. 31–37.) Any passive two-pole of order *n* may be realized by connecting a resistance across one pair of terminals of a resistanceless quadripole of the same order which may contain gyrators. The general two-pole of order *n* can thus be realized by one network containing the minimum number of elements, namely 1 resistor, *n* capacitors and inductors, and *n* ideal transformers and gyrators.

621.392.4 **3365**

Realization of Linear Two-Pole Networks with Prescribed Frequency Dependence, taking account of Losses in Coils and Capacitors.—Nai-Ta Ming. (*Arch. Elektrotech.*, April 1949, Vol. 39, No. 6, pp. 359–387.)

621.392.5 **3366**

Reactance Quadripole with Given Blocking Points and Given Unipolar No-Load or Short-Circuit Resistance.—H. Piloty. (*Arch. elekt. Übertragung*, July/Aug. 1947, Vol. 1, Nos. 1/2, pp. 59–70.) Consideration of the conditions under which such a quadripole is physically realizable.

621.392.5 **3367**

Realization of Linear Four-Pole Networks with Prescribed Frequency Dependence, taking account of Corresponding Losses in all Coils and Capacitors.—Nai-Ta Ming. (*Arch. Elektrotech.*, 1949, Vol. 39, No. 7, pp. 452–471.)

621.392.5 **3368**

On the Design of Networks for Constant Time Delay.—M. H. Hebb, C. W. Horton & F. B. Jones. (*J. appl. Phys.*, June 1949, Vol. 20, No. 6, pp. 616–620.) The 'group delay time' represents the delay for a signal composed of a narrow band of frequencies. The deviation of the 'group delay time' from a constant value is investigated as a function of the circuit parameters for a simple LC line, an *m*-derived section, a type-B compensating network, and for two other networks. The relative performance of these networks and properties of the image impedance are discussed.

621.392.52 **3369**

Design of Dissipative Band-Pass Filters Producing Desired Exact Amplitude-Frequency Characteristics.—M. Dishal. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, pp. 1050–1069.) 1948 I.R.E. National Convention paper. A basic method is described for obtaining the exact values required for all circuit constants in a band-pass network using *n* finite-*Q* resonant circuits, to obtain either the critical-shape-coupled type of response, or the over-coupled type. The general equation giving the gain obtained with the desired response shape is derived, together with equations for the associated phase characteristics. The particular equations for designing single-, double-, triple- and stagger-tuned networks to produce either of the above amplitude-response shapes are tabulated. The new design method and that using the poles of the network are compared.

621.392.52 **3370**

L-Section Low-Pass Filter Design.—P. G. Sulzer. (*Communications*, July 1949, Vol. 29, No. 7, pp. 22–25, 32.) The theory of such filters is discussed, with special reference to the effect of various types of terminating impedance. Applications as power-supply filters, decoupling filters and transmission-type filters are considered. Design charts are provided.

621.392.52 **3371**

Smoothing Circuits : Resistance - Capacitance.—"Cathode Ray". (*Wireless World*, Oct. 1949, Vol. 55, No. 10, pp. 389–393.) A non-mathematical discussion intended to lead up to a 'reliable skeleton of information on filters'. The calculation of the best number of sections for such circuits is considered.

621.392.52 : 621.396.41 **3372**

Significance and Application of Frequency Filters in U.S.W. Multichannel Systems.—Staub. (*See* 3545.)

621.392.52.012 **3373**

Use of a Mechanical Harmonic Synthesizer in Electric Wave Filter Analysis.—S. L. Brown & J. M. Sharp. (*J. appl. Phys.*, June 1949, Vol. 20, No. 6, pp. 578–582.) The frequency is replaced by $R - r \cos \theta$, where R and r are arbitrary, and only θ varies. The synthesiser has 15 sine and 15 cosine harmonic elements for θ. The cut-off frequency, attenuation and phase shift of a filter are determined by plotting with the synthesiser the numerator and denominator of the quantity $(x_1/-4x_2)^{\frac{1}{2}}$, where x_1 is the series reactance and x_2 the shunt reactance. The image impedances can be similarly obtained.

621.392.52.029.64 **3374**

Microwave Filter Theory and Design.—J. Hessel, G. Goubau & L. R. Battersby. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, pp. 990–1000.) A theory of waveguide filters with identical links, and of matching such filters to a transmission line. 'Wave matrices' are used in preference to lumped-element theory; the elements of these matrices are closely related to the reflection and transmission coefficients and can be determined more directly than the coefficients of an impedance or admittance matrix. The e.m. state of the impedors and transducers is described by relations between the incident and reflected waves; each transformation by a line section results only in a phase shift of these waves. Each filter stage is characterized by two angles which can be determined by simple measurements. Formulae relating to insertion properties are given in terms of these angles. The theory is applied to direct and quarter-wave coupled band-pass iris filters; good agreement with experimental results is obtained.

621.396.611 : 621.392.52 **3375**

On the Connection between Oscillators and Filters.—W. Herzog. (*Arch. elekt. Übertragung*, July/Aug. 1947, Vol. 1, Nos. 1/2, pp. 47–58.) The use of quadripole filters as oscillators is investigated and general oscillation conditions are deduced. A relation is established between these conditions and the transmission properties of the network when used as a filter. The advantages of bridge oscillators such as that of Meacham (263 of 1939) are pointed out. A circuit is considered which permits the selection of either of two frequencies of equal oscillation strength.

621.396.611.1 **3376**

Resonance Phenomena in Oscillatory Circuits.—E. de Gruyter. (*Bull. schweiz. elektrotech. Ver.*, 27th Nov. 1948, Vol. 39, No. 24, pp. 791–801. In German, with French summary.) Detailed treatment of (*a*) voltage variations at the circuit terminals and across each circuit element, (*b*) current and phase in the various elements, (*c*) active power in the circuit. The equations for complex oscillatory circuits are derived from those for elementary circuits, suitable functions being introduced to take account of losses.

621.396.611.3 **3377**

Graphical Analysis of Tuned Coupled Circuits.—A. E. Harrison & N. W. Mather. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, pp. 1016–1020.) A new basis for normalizing the transfer admittance of two coupled tuned circuits permits the representation of this admittance by a single universal parabola in the complex plane. Within the limitations of the assumptions of high *Q* and small frequency deviations, data can be obtained from this parabola for different *Q* ratios, as well as the usual values of coupling and relative tuning. The method also simplifies the calculation of the input admittance of coupled circuits. Extension of the method to triple tuned circuits is possible, but the applicability of a single universal curve is lost.

621.396.611.4 : 621.396.679.4 : 621.396.931 **3378**

Cavity Resonators in Mobile Communications.—H. Magnuski. (*Communications*, Aug. 1949, Vol. 29, No. 8, pp. 8–11.) A cavity resonator acts as a very-high-*Q* circuit which can be inserted between the transmitter and the aerial to decrease spurious emissions of the transmitter. It also enables several transmitters to use one aerial without interference. A cavity inserted between the receiver and the aerial provides high selectivity at r.f. level and rejects an unwanted signal before it reaches any receiver valve. Cavity resonators can also be used to reduce intermodulation interference.

621.396.615 **3379**

Twin Oscillator.—T. Kirby. (*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 170..182.) Designed primarily as a stable oscillator variable over a narrow band of frequencies. The output used is the difference between those of physically identical oscillators, one of which is padded with capacitors having zero temperature coefficient.

621.396.615 : 621.396.822 **3380**

The Influence of Thermal Resistor-Noise and of the Shot Effect on the Interference Modulation of Oscillators.—A. Spälti. (*Bull. schweiz. elektrotech. Ver.*, 26th June 1948, Vol. 39, No. 13, pp. 419–427. In German, with French summary.) The magnitude of the interference modulation due to these effects is calculated and the conditions which an oscillator must satisfy for such modulation to be as small as possible are established. In practice these conditions can be fulfilled without much difficulty for frequencies up to 1 000 Mc/s; at still higher frequencies a.m. loses its significance. For optimum results, interference modulation must be avoided not only in the transmitter oscillator, but also in the receiver heterodyne oscillator, since any modulation of the local oscillator must necessarily be transferred to the i.f. of the receiver.

621.396.615.17 **3381**

A Voltage-Controlled Multivibrator.—J. M. Sturtevant. (*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 144..158.) Regenerative feedback may be applied to multivibrators and blocking oscillators to give a linear relation between frequency and the first or second power of an input d.c. voltage. Theory and practical circuits are discussed.

621.396.619.11.029.64 **3382**

Amplitude Modulation of Centimetre Waves.—P. O. Hawkins & C. C. Costain. (*Nature, Lond.*, 27th Aug. 1949, Vol. 164, No. 4165, p. 356.) A beam of electrons injected into a tube containing an inert gas at low pressure attenuates centimetre waves traversing the tube, provided that the electron energy is sufficient to ionize the gas. With one arrangement, maximum attenuation achieved was 50 db, with the first 15 db linearly related to applied electron current. Applications are (*a*) a modulator, and (*b*) a wide-band attenuator of low insertion loss and quick response suitable for very short pulses.

621.396.619.23 **3383**

Design Equations for Reactance-Tube Circuits.—J. D. Young & H. M. Beck. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, pp. 1078–1082.) Design equations are derived for several systems of reactance-valve modulation, without using the usual approximations. Expressions are obtained empirically for the total band swept; the effect of each parameter can be directly determined. The usual simplifying relations between the impedances of the feedback network were not assumed. The critical point where a given network changes from an apparent inductance to an apparent capacitance is noted.

621.396.645 **3384**

The Design and Limitations of D.C. Amplifiers: Parts 1 & 2.—E. J. Harris & P. O. Bishop. (*Electronic Engng*, Sept. & Oct. 1949, Vol. 21, Nos. 259 & 260, pp. 332–335 & 355–359.) A general review with a bibliography of 38 references. Sources of random fluctuations are considered; these are on the whole more important than sources of disturbance related to external parameters. The importance of stable power-supply voltage is stressed. Design of balanced input stages, interstage coupling, and stabilization by negative feedback are discussed.

621.396.645 : 578.088.7 **3385**

Carrier-Type D.C. Amplifier for Biological Research.—C. R. Maduell, Jr, & H. M. Owen. (*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 128..182.) For continuous recording of small slow mechanical motions. The motion is made to change the a.c. impedance of two coils connected in a conventional Wheatstone bridge circuit. Resulting variations in the 1 000-c/s bridge output current are amplified and rectified, and actuate a recorder.

621.396.645 : 621.318.572 **3386**

Regenerative Amplifiers.—Y. P. Yu. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, pp. 1046–1049.) If a large amount of regeneration is used, the output voltage of an amplifier can be made to change abruptly from one constant value to another when the input voltage is raised to a critical value, and to change back to its original value when the input is reduced to another critical value. This principle is applied to (*a*) indication of the instant when two voltages become equal, (*b*) a peak voltmeter circuit, (*c*) a pulse-width discriminator circuit.

621.396.645 : 621.385.029.63/.64 **3387**

Double-Stream Amplifiers.—J. R. Pierce. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, pp. 980–985.) In the structure here analysed, v.m. of the two streams occurs when they pass across the gap between the grids of the input resonator R_1 which is fed by input line L_1. This v.m. sets up an increasing space-charge wave, which grows in the space between input resonator R_1 and output resonator R_2. The convection current associated with the wave excites resonator R_2 and so transfers power to the output line L_2. The electron streams are collected on an anode. Formulae useful for evaluating the gain are given. See also 2486 of September (Pierce & Hebenstreit) and 2487 of September (Hollenberg).

621.396.645 : 621.385.029.63/.64 **3388**

The Double-Stream Amplifier.—A. V. Hollenberg. (*Bell Lab. Rec.*, Aug. 1949, Vol. 27, No. 8, pp. 290–292.) See 2487 of September.

621.396.645 : 621.396.9 **3389**

Considerations in the Design of a Radar Intermediate-Frequency Amplifier.—A. L. Hopper & S. E. Miller. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, p. 1069.) Correction to 690 of 1948.

621.396.662.2 **3390**

The Theory and Design of Progressive and Ordinary Universal Windings.—A. W. Simon. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, pp. 1029–1030.) Comment on 1332 of 1948 (Kantor).

621.396.69 + 621.317.7 + 621.38] : 061.4 **3391**

Electronic Equipment at Radiolympia, 1949.—(*See* 3472.)

621.396.813 **3392**

On the Connection between Amplitude and Phase Distortion.—K. W. Wagner. (*Arch. elekt. Übertragung*, July/Aug. 1947, Vol. 1, Nos. 1/2, pp. 17–28.) The complex transfer function of an electrical transmission circuit is

$$f(j\omega) = P + jQ = e^{b+ja}$$

The system is free from distortion when $db/d\omega = 0$ and $da/d\omega = \text{const.}$ Amplitude distortion occurs if the first of these conditions is not satisfied and phase distortion when the second does not hold. P and Q, and hence b and a, are not independent of one another; f is an analytical function of the complex frequency $\zeta = \gamma + j\omega$; hence P and Q are related by the Cauchy-Riemann differential equations. The theory of functions can be used to determine either P or Q when the other is given. The calculation can also be effected by use of the Laplace transformation and Fourier integral.

The above considerations are applied to the ideal low-pass filter, which provides distortion-free transmission between $\omega = 0$ and $\omega = \Omega$ and stops all higher frequencies. It is shown that freedom from distortion can only be reached approximately; the distortion increases with increasing frequency and may be very great near the limiting frequency. The region of great distortion decreases with increasing order number k of the filter; for the ideal filter at the limiting frequency, $a = k\pi$. The degree of approximation to the ideal filter for different values of k is shown by formulae and curves. The discussion applies to any type of filter network.

621.397.645 **3393**

Cathode Neutralization of Video Amplifiers.—J. M. Miller. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, pp. 1070–1073.) The usual cathode bypass capacitors are replaced by a resistor connected from each cathode to the cathode of the next stage. No gain need be sacrificed, and l.f. phase shift is greatly reduced. Phase shift and h.f. response are improved by adding a small capacitance in parallel with a portion of the intercathode resistance. Gain and stability equations are derived and a practical circuit diagram is given.

621.397.645 **3394**

Design of a [television] **I.F. Amplifier using Stagger-Tuned Circuits.**—R. Aschen. (*T.S.F. pour Tous*, Sept. 1949, Vol. 25, No. 251, pp. 293–295.) To cover a bandwidth of 46 Mc/s to 56 Mc/s with an attenuation of 3 db and an actual gain of 60 db, four EF42 valves, with five tuned circuits, are used. Graphs are given from which the pass band and resistance of each stage are calculated. See also 678 of 1947 (Baum).

621.397.645 : 621.3.015.3 **3395**

A New Figure of Merit for the Transient Response of Video Amplifiers.—R. C. Palmer & L. Mautner. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, pp. 1073–1077.) 1948 I.R.E. National Convention paper. The figure of merit F proposed is $F = a\, e^{-b\gamma^2}/\tau$, where a, b are constants, τ is the rise time and γ the fractional overshoot. For a shunt-peaked stage, F is a maximum for an overshoot of about 2%.

621.396.001.4 **3396**

Radio Servicing : Theory and Practice. [Book Review] —A. Marcus. Publishers : Prentice-Hall, New York, 1948, 752 pp., $5.95. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, p. 1038.) Intended " for those who are not beginners in radio nor yet advanced enough to study the subject on an engineering level ". A clear nonmathematical discussion of valves and their use as rectifiers, a.m. detectors, amplifiers and oscillators. Power supplies, receivers, amplifiers, components, special valves, tuning and control, servicing procedures and repair and alignment technique are also considered.

GENERAL PHYSICS

53.081 + 621.3.081 **3397**

The Development of Electrical Units in the Last Hundred Years. The Change in the Electrical Units on 1st January 1948.—U. Stille. (*Arch. Elektrotech.*, Sept. 1948, Vol. 39, Nos. 2/3, pp. 130–164.) Review and discussion, with a comprehensive conversion table from international to absolute units.

53.081 + 621.3.081 **3398**

On the Replacement of the International by the Absolute Electrical Units.—H. v. Steinwehr. (*Arch. Elektrotech.*, June 1948, Vol. 39, No. 1, pp. 27–30.)

53.081 + 621.3.081 **3399**

Old and New Electrical Units. A Review.—J. Fischer. (*Arch. Elektrotech.*, Feb. 1949, Vol. 39, No. 5, pp. 340–358.)

534.2.001.8 : 621.391 **3400**

On the Analogy between Angle-of-Incidence and Frequency Problems.—L. Cremer. (*Arch. elekt. Übertragung*, July/Aug. 1947, Vol. 1, Nos. 1/2, pp. 28–47.)

537.122 **3401**

Recent Developments in the Theory of the Electron.—V. F. Weisskopf. (*Rev. mod. Phys.*, April 1949, Vol. 21, No. 2, pp. 305–315.)

537.311.62 **3402**

Skin Effect in Conductors and in Insulators with Conducting Surface-Layer.—W. Dällenbach. (*Bull. schweiz. elektrotech. Ver.*, 10th July 1948, Vol. 39, No. 14, pp. 439–446. Correction, *ibid.*, Vol. 39, No. 15, p. 481. In German, with French summary.) Formulae are derived for the loss per cm² for plane surfaces, taking account of displacement currents. In the case of a highly conductive surface layer on a material of poor or zero conductivity, the loss due to the Kelvin effect reaches a minimum value for a certain thickness of the surface layer. For greater thicknesses the loss increases again.

537.311.62 **3403**

Relaxation in the Anomalous Skin Effect.—K. F. Niessen. (*Philips Res. Rep.*, Feb. 1949, Vol. 4, No. 1, pp. 38–48.) Comment on 1014 of 1948 (Pippard). If for infinitely long free paths of the electrons the relaxation is taken into account, a skin impedance independent of the conductivity is found. The influence of relaxation on Pippard's concept of ineffectiveness is considered.

537.312 : 621.315.61 **3404**

Electron Bombardment Conductivity.—F. Ansbacher & W. Ehrenberg. (*Nature, Lond.*, 23rd July 1949, Vol. 164, No. 4160, pp. 144–145.) Typical results obtained under d.c. conditions with very thin dielectric films sandwiched between conducting layers are shown graphically and discussed.

537.523.3 **3405**

Point-to-Plane Corona Onsets.—W. N. English & L. B. Loeb. (*J. appl. Phys.*, July 1949, Vol. 20, No. 7, pp. 707–711.) The effect of point material and point radius on positive and negative intermittent corona onset potentials in air at atmospheric pressure is investigated.

537.525.92 **3406**

Space-Charge Wave Amplification Effects.—V. A. Bailey. (*Phys. Rev.*, 1st April 1949, Vol. 75, No. 7, pp. 1104–1105.) Discussion of the relation between the work of Haeff (1024 of April), Pierce (689 of March), and the author's theory of plane waves in an ionized gas (2785 of October). To explain solar and other noise, it is not necessary to postulate interaction between two or more different components of the stream.

537.533 **3407**

Thermionic Emission.—C. Herring & M. H. Nichols. (*Rev. mod. Phys.*, April 1949, Vol. 21, No. 2, pp. 185–267. Bibliography, pp. 267–270.) A detailed and critical review of present knowledge of the emission from clean metals.

Chapter 1 : An exposition of the thermodynamic principles underlying emission from uniform surfaces.

Chapter 2 : The experimental evidence for non-uniformity of the properties of the different crystal surfaces of the same metal is summarized and the way in which this affects the interpretation of surface phenomena is indicated.

Chapter 3 : The experimentally-determined emission constants for clean metals, published since 1935, are tabulated and the methods by which they were obtained are considered.

Chapter 4 : Discussion of developments of modern quantum theory which have a bearing on thermionic and related phenomena.

538.11 **3408**

Concerning the Perfect Magnet.—É. Brylinski. (*Rev. gén. Elect.*, Aug. 1949, Vol. 58, No. 8, pp. 315–320.) The classic definition of such a magnet is recalled and consequences of the definition are examined. Numerical data for some steel magnets are discussed. A formula for the internal and external magnetic energy of the perfect magnet is given which is in agreement with the classic formula.

538.569.4.029.64 : 546.171.1 **3409**

Pressure Broadening in the Inversion Spectrum of Ammonia.—H. Margenau. (*Phys. Rev.*, 1st July 1949, Vol. 76, No. 1, pp. 121–124.) A formula is developed to explain the low-pressure line widths observed by Bleaney & Penrose (1916 of 1948). Assumptions are those characteristic of the statistical theory of pressure broadening.

538.569.4.029.65† : 546.21 **3410**

The Microwave Absorption Spectrum of Oxygen.—M. W. P. Strandberg, C. Y. Meng & J. G. Ingersoll. (*Phys. Rev.*, 15th May 1949, Vol. 75, No. 10, pp. 1524–1528.) The absorption for $\lambda \approx 5$ mm was measured. Results agree satisfactorily with the theoretical curves of Van Vleck (3098 of 1947) for an assumed line breadth $\Delta\nu = 0.015$ to $0.02\ \mathrm{cm}^{-1}$. Observations of the absorption in mixtures of oxygen and nitrogen indicate a disparity of O_2 and N_2 collision cross-sections. Nitrogen may cause an anomalous narrowing of the oxygen absorption line.

538.6 **3411**

Penetration of an Alternating Magnetic Field into Solid Iron with Permeability dependent on the Field Strength.—F. Nechleba. (*Arch. Elektrotech.*, Feb. 1949, Vol. 39, No. 5, pp. 301–318.)

GEOPHYSICAL AND EXTRATERRESTRIAL PHENOMENA

523.72 : 621.396.822 **3412**

On the Origin of Solar Radio Noise.—A. V. Haeff. (*Phys. Rev.*, 15th May 1949, Vol. 75, No. 10, pp. 1546–1551.) Observed anomalous r.f. radiations from the sun are associated with sunspot activity and are believed to be generated within intermingling streams of charged particles. Such streams can greatly amplify initial space-charge fluctuations. The generation of r.f. energy in this way is considered theoretically; the most intense radiation is thus predicted in the frequency range 30–60 Mc/s and the corresponding absolute value of radiation intensity at the earth's surface is calculated as 7×10^{-22} to 2×10^{-22} W/cm^2 per c/s. These values agree well with measurements. A formula for the most probable spectral distribution of the anomalous r.f. radiation is given.

523.72.029.6 : 621.396.822 **3413**

The Significance of the Observation of Intense Radio-Frequency Emission from the Sun.—M. Ryle. (*Proc. phys. Soc.*, 1st Aug. 1949, Vol. 62, No. 356A, pp. 483–491.) Various theories are summarized. The mechanisms proposed for the maintenance of coherent electron oscillations are examined in detail; they explain adequately the oscillations observed in discharge tubes but fail to explain satisfactorily the maintenance of electron oscillations in the solar corona. Observed results can only be accounted for by the occurrence of electron temperatures up to 10^{10} deg.K in the solar corona near sunspots. The maintenance of such temperatures was considered in an earlier paper (696 of March).

523.746 "1948" **3414**

Final Relative Sunspot-Numbers for 1948.—M. Waldmeier. (*J. geophys. Res.*, June 1949, Vol. 54, No. 2, pp. 187–189.)

523.746 "1949.01/.03" **3415**

Provisional Sunspot-Numbers for January to March, 1949.—M. Waldmeier. (*J. geophys. Res.*, June 1949, Vol. 54, No. 2, p. 192.)

523.75 : 621.396.11.029.45 **3416**

The Study of Solar Flares by means of Very Long Radio Waves.—R. N. Bracewell & T. W. Straker. (*Mon. Not. R. astr. Soc.*, 1949, Vol. 109, No. 1, pp. 28–45.) Anomalies in the phase of the signal received from a very-long-wave transmitter provide a valuable indication of the occurrence of solar flares. Attempts have been made to correlate the starting times of the anomalies with the reported times of solar flares observed visually, but these have not been very fruitful. Better agreement is obtained in comparisons with photometric measurements of the width of the Hα line.

The size, duration and time of growth of phase anomalies are analysed statistically and it is concluded that observation of these anomalies provides the best available method of continuously monitoring solar activity.

523.78 "1948.11.01" : 523.72.029.63 **3417**

Eclipse Observations of Solar Radiation at a Wave-Length of 50 cm.—W. N. Christiansen, D. E. Yabsley & B. Y. Mills. (*Nature, Lond.*, 1st Oct. 1949, Vol. 164, No. 4170, pp. 569–570.) Discussion of 50-cm solar radiation observed at 3 Australian stations during the partial eclipse of 1st November 1948. Departures from a smooth curve in the records were used to locate small areas of greater radio brightness than their background; most of these areas were close to optical features on the sun's disk. The average temperature of the bright areas was estimated at 5×10^6 deg. K. The existence of limb brightening was neither proved nor disproved. A full account of this work will be published elsewhere.

550.38 "1948.10/.12" **3418**

Selected Days, Preliminary Mean *K*-Indices, and Preliminary *C*-Numbers for Fourth Quarter, 1948.—H. H. Howe. (*J. geophys. Res.*, June 1949, Vol. 54, No. 2, pp. 189–191.)

550.38 "1949.01/.03" **3419**

Cheltenham [Maryland] **Three-Hour-Range Indices *K* for January to March, 1949.**—P. G. Ledig. (*J. geophys. Res.*, June 1949, Vol. 54, No. 2, p. 192.)

550.385 : 537.591 **3420**

Magnetic Storms and Cosmic-Ray Intensity.—H. R. Sarna & O. Parkash. (*Nature, Lond.*, 1st Oct. 1949, Vol. 164, No. 4170, pp. 588–589.) There is little correlation between changes in cosmic-ray intensity and those in geomagnetic intensity except during magnetic storms, when the correlation coefficient is sometimes positive and sometimes negative.

550.385 "1949.01.03" **3421**

Principal Magnetic Storms [Jan.–March 1949].—(*J. geophys. Res.*, June 1949, Vol. 54, No. 2, pp. 193–195.)

551.510.52 **3422**

Charts of Dielectric Constant or Refractive Index of the Troposphere.—A. W. Friend. (*Bull. Amer. met. Soc.*, Dec. 1948, Vol. 29, No. 10, pp. 500–509.) For the conversion of radiosonde data of pressure, temperature and water-vapour content to the dielectric constant or r.f. refractive index of the atmosphere.

551.510.535 **3423**

A Note on the Maximum Height of Reflection of a Radio Wave in a Curved Ionosphere Layer.—J. M. Kelso. (*J. appl. Phys.*, June 1949, Vol. 20, No. 6, pp. 632–633.) A theoretical study based on Bouger's rule relating index of refraction, angle of incidence and layer height, and on an expression using Hacke's notation (3115 of 1948) in which the electron density is a parabolic function of height. For a plane ionosphere, reflections occur for all heights lying below the level of maximum ionization and above the bottom of the parabolic region. For a curved ionosphere there is an upper limit to the possible heights of reflection; this limit is below the level of maximum ionization.

551.510.535 **3424**

Tilts in the Ionosphere.—W. Ross & E. N. Bramley. (*Nature, Lond.*, 27th Aug. 1949, Vol. 164, No. 4165, pp. 355–356.) Simultaneous observations were made with two direction finders 10 km apart, on signals from a transmitter 700 km further north. Bearings taken during the day on h.f. signals reflected from the F region show fluctuations of a few degrees from the true great-circle bearing. These fluctuations have a period of 10–30 min, and are attributed to a tilting or wrinkling of the reflecting layer. The fluctuations were similar at both receiving stations, showing that a tilt of about 4° from the horizontal was substantially uniform over a distance of 5 km. See also 2125 of 1947.

551.510.535 **3425**

The Ionosphere over Mid-Germany in July 1949.—Dieminger. (*Fernmeldetech. Z.*, Sept. 1949, Vol. 2, No. 9, p. 284.) Continuation of 3131 of November. Abnormalities are noted.

551.510.535 : 550.38 **3426**

Theory of Lunar Effects and Midday Decrease in F_2 Ion-Density at Huancayo, Peru.—A. G. McNish & T. N. Gautier. (*J. geophys. Res.*, June 1949, Vol. 54, No. 2, pp. 181–185.) The diurnal variation of the earth's magnetic field gives rise to forced diffusion of ions in the F_2 layer. This may explain the midday decrease in F_2 critical frequency. When solar and lunar magnetic variations are in phase, the midday values of critical frequency are lower than when these variations are out of phase, as predicted theoretically.

551.510.535 : 550.38 **3427**

Seasonal Variation of World-Wide F_2 Ionization for Noon and Midnight Hours.—H. L. Lung. (*J. geophys. Res.*, June 1949, Vol. 54, No. 2, pp. 177–179.) For the noon hours there is a definite dip at the geomagnetic equator with a maximum on each side, as in the curves published by Appleton and Liang for the equinoctial months (1031 of 1948 and back references). A second maximum is also indicated at about 50° geomagnetic latitude. The midnight curves show only one maximum, which closely follows the solar declination. Midnight ionization appears to provide a better criterion of seasonal variation than noon ionization.

551.524.7 + 551.557 **3428**

Wind and Temperature Measurements up to 30 km.—F. J. Scrase. (*Nature, Lond.*, 1st Oct. 1949, Vol. 164, No. 4170, p. 572.) Seven successful ascents to 30 km have been made with large sounding-balloons. Results are compared with theoretical predictions. Further details are given in *Met. Mag.*, Oct. 1949.

551.594.6 **3429**

Recording of Atmospherics on board the Commandant Charcot.—R. Bureau & M. Barré. (*C. R. Acad. Sci., Paris*, 5th Sept. 1949, Vol. 229, No. 10, pp. 525–527.) A short account of the results obtained on a frequency of 27 kc/s during a voyage from Brest round the Cape of Good Hope to Australia, thence to Adélie Land and back to Brest via the Suez Canal. In general, the daily variation is characterized by a maximum in the afternoon and a second maximum at night. Rapid rises or falls near sunset or sunrise are attributable to the difference of range of atmospherics during the day and the night.

Comparison of the curves with those obtained at Bagneux reveals remarkable similarities, even for the diurnal variations and for distances of the order of 2 500–5 000 km. The Bagneux records on 12.5 kc/s show the greatest similarity to those of the Commandant Charcot; in some cases the two records are almost identical. Sudden commencements of ionospheric perturbations observed on the ship and at Bagneux also show many instances of synchronism.

LOCATION AND AIDS TO NAVIGATION

621.396.9 : 621.396.645 **3430**

Considerations in the Design of a Radar Intermediate-Frequency Amplifier.—A. L. Hopper & S. E. Miller. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, p. 1069.) Correction to 690 of 1948.

621.396.93 **3431**

Medium-Frequency Crossed-Loop Radio Direction Finder with Instantaneous Unidirectional Visual Presentation.—L. J. Giacoletto & S. Stiber. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, pp. 1082–1088.) A crossed-loop collector system, electronic switch, single-superheterodyne receiver and synchronous rectifier are used. Design data and operating characteristics are considered, with details of the new components.

621.396.932 **3432**

Decca Radar.—(*Wireless World*, Sept. 1949, Vol. 55, No. 9, p. 345.) Brief description of a low-priced equipment suitable for small vessels. Separate reflectors are provided for transmission and reception in the scanner unit.

621.396.933 **3433**

The Program for New Aids to Air Navigation.—D. W. Rentzel. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, pp. 1041–1042.) A brief survey of present systems and future plans. See also 2236 of August (Sandretto) and 3149 of November.

621.396.933 **3434**

Loran.—M. Portier. (*Onde élect.*, July 1949, Vol. 29, No. 268, pp. 286–304.) An account of the principles, equipment and operation of standard loran. This system is used by all aircraft of the Compagnie Air France on the North Atlantic route, whose pilots appreciate specially its rapidity and accuracy of measurement. Long-wave loran, which requires phase comparison in the receiver, is also mentioned.

MATERIALS AND SUBSIDIARY TECHNIQUES

537.228.1 **3435**

Mechanical Development of EDT Crystal Units.—A. W. Ziegler. (*Bell Lab. Rec.*, July 1949, Vol. 27, No. 7, pp. 245–250.) Details of the production and mounting of EDT crystals. These are being produced to replace quartz, which costs more, in telephone filter circuits etc. Since EDT is soluble in water, the crystals may be sliced with a wet string, and the resonance frequency may be adjusted by wiping with a wet cloth.

538.221 **3436**

Coercive Field and Crystal Dimensions.—F. Bertaut. (*C. R. Acad. Sci., Paris*, 8th Aug. 1949, Vol. 229, No. 6, pp. 417–419.) According to the theory of Néel (3151 and 3152 of 1947) the existence of high coercive fields in iron powders is related to the combination of three conditions which are essentially geometrical. Measurements on powders of spongy iron, prepared by reduction of ferrous formate in hydrogen at various temperatures, confirm Néel's theory. See also 2816 of October (Steinitz).

538.221 : [621.318.22 + 621.318.32 **3437**

On New Ferromagnetic Materials.—K. Sixtus. (*Arch. Elektrotech.*, Dec. 1948, Vol. 39, No. 4, pp. 260–266.) A review of the properties of permanent-magnet and core materials now available, including various special alloys, metal-powder products and ferrites. See also 3447 of 1948 (Snoek), 2809 of October and 3159 of November (Néel).

546.289 : 537.311.33 **3438**

Dependence of Resistivity of Germanium on Electric Field.—R. Bray. (*Phys. Rev.*, 1st July 1949, Vol. 76, No. 1, pp. 152–153.) The Hall constant for *N*-type Ge in a transverse magnetic field of 4 600 gauss was found to decrease rapidly with increasing electric field strength. It was measured by the high-field pulse technique. The dependence of conductivity on temperature was studied for various transverse electric fields. Results appear to be consistent with the hypothesis that holes are injected into the *N*-type material from the positive metal contact, and are drawn into the material by the electric field. Similar results are obtained for P-type Ge. See also 264 of January (Bardeen & Brattain) and 1688 of June (Ryder & Shockley).

546.431.82 : 621.395.61/.62 **3439**

Barium-Titanate Ceramic as an Electromechanical Transducer.—W. P. Mason. (*Bell Lab. Rec.*, Aug. 1949, Vol. 27, No. 8, pp. 285–289.) The effect of applied a.c. and d.c. fields on the atomic structure of $BaTiO_3$ is considered. If 3–4% of lead titanate is introduced into a sample of $BaTiO_3$, an isotropic ceramic is obtained which has permanent remanent polarization. This material can behave as an electromechanical transducer when cut into any shape. Advantages and possible applications are discussed.

546.482.21 : 535.215.1 **3440**

On the Photoelectric Properties of Cadmium-Sulphide Single-Crystals.—J. Fassbender. (*Ann. Phys., Lpz.*, 15th June 1949, Vol. 5, Nos. 1/2, pp. 33–50.)

620.197 : 679.5 **3441**

Potted Subassemblies for Subminiature Equipment.—W. G. Tuller. (*Electronics*, Sept. 1949, Vol. 22, No. 9, pp. 104–105.) Design and construction procedures for potting are discussed fully. See also 442 of 1948.

621.315.5/.6 **3442**

New Materials and their Engineering Significance.—(*Nature, Lond.*, 24th Sept. 1949, Vol. 165, No. 4169, pp. 514–517.) Summaries of three papers read at a meeting of the Engineering Section of the British Association, namely :— New Dielectric and Semi-Conducting Materials, by R. W. Sillars ; Magnetic Materials for Electrical Power Plants, by F. Brailsford; Metals for High Duty, by R. W. Bailey.

621.315.5/.6 **3443**

Properties of Conductive Plastics.—(*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 96–99.) Description of Markite materials, which can be moulded but have electrical resistivities comparable with that of Hg. Many of these materials can be soldered or electroplated directly. Applications include shielding, moulded circuits, resistors and commutators.

621.315.59 : 621.385.032.216 **3444**

Semi-Conducting Properties in Oxide Cathodes.—N. B. Hannay, D. MacNair & A. H. White. (*J. appl. Phys.*, July 1949, Vol. 20, No. 7, pp. 669–681.) The electrical conductivity of (Ba,Sr)O was studied as a function of temperature before and after activation with methane. (Ba, Sr)O appears to be a ‘ reduction ’ semiconductor whose conduction electrons probably arise from a stoichiometric excess of (Ba, Sr) atoms in solid solution. The electrical conductivity and the thermionic emission of a (Ba, Sr)O cathode are directly proportional through three orders of magnitude of activation, as predicted by semiconductor theory.

621.315.592† **3445**

Theory of Electronic Semiconductors and of their Complex Derivatives.—S. Teszner. (*Bull. Soc. franç. Élect.*, Aug. 1949, Vol. 9, No. 95, pp. 401–432.) Various theories concerning the properties of semiconductors are reviewed. The physical mechanism of the phenomena in the boundary layer of a semiconductor and in complex derivatives such as thermistors is discussed. A tentative theory is proposed which is in better agreement with experiment than many previous theories.

621.315.611.015.5 **3446**

The Electrical Breakdown of Solid Insulators.—K. W. Wagner. (*Arch. Elektrotech.*, Dec. 1948, Vol. 39, No. 4, pp. 215–233.) General discussion, including theory of heat breakdown, effect of electric field, time effects, breakdown under alternating voltages and influence of frequency and temperature. Curves for typical materials illustrate the effects observed.

621.315.612 **3447**

Review of New Developments in H.F. Ceramics.—C. Schreck. (*Fernmeldetech. Z.*, Sept. 1949, Vol. 2, No. 9, pp. 285–295. Bibliography, p. 296.) Discussion of the mechanical and electrical properties of materials produced in Germany, America, Russia and England for both high-power and low-power equipment. In the case of capacitor materials, the temperature coefficient of the dielectric constant is considered with particular reference to the design of temperature-compensated circuits.

621.315.614 **3448**

Dependence of the D.C. Resistance and Loss Angle of Paper on its Dryness and Temperature.—H. Veith. (*Frequenz*, June & July 1949, Vol. 3, Nos. 6 & 7, pp. 165–173 & 216–223.) Apparatus for measurements at temperatures between −50° and +50°C and at frequencies between 400 c/s and 100 kc/s is described. Results are shown in numerous diagrams. The d.c. resistance falls exponentially with the moisture content; it decreases to about a tenth for a 1.5% increase of moisture content. The temperature coefficient of the d.c. resistance is about the same for different moisture contents. The variation of a.c. resistance with humidity is much less than that for d.c., particularly for low temperatures and high frequencies. The loss angle at first increases only slightly with moisture content, but beyond a certain point, which at low temperatures moves towards higher humidity values, the increase becomes somewhat greater. At low temperatures even a water content of 10% produces only a slight increase of loss angle. The results are discussed with reference to the structure of cellulose.

621.315.616 **3449**

A Room-Temperature Transition in Polytetrafluoroethylene.—H. A. Rigby & C. W. Bunn. (*Nature, Lond.*, 1st Oct. 1949, Vol. 164, No. 4170, p. 583.) As the temperature increases through 20°C the specific volume of polytetrafluoroethylene increases suddenly by about 1%. X-ray-diffraction evidence that this is associated with a change in crystal structure is discussed.

621.315.616 : 620.197 **3450**

“ Araldite.”—C. J. Moss. (*Electronic Engng*, Oct. 1949, Vol. 21, No. 260, pp. 389–392.) A synthetic resin of complex composition which does not give off water or volatile products when it sets, does not shrink much when it hardens, and adheres to metals, mica, quartz, porcelain, glass etc. It appears to be capable of meeting all the sealing requirements for Service equipment. The material was developed by Messrs. Ciba of Basle.

621.315.616 : 679.5 : 621.791 **3451**

Radio Frequency Welding of Plastics.—L. Grinstead & H. P. Zade. (*J. Brit. Instn Radio Engrs*, Sept. 1949, Vol. 9, No. 9, pp. 322–338.) Heated-tool and hot-gas welding methods depend upon the thermal properties of the material to be welded, whereas r.f. methods make use of the dielectric losses occurring when the material is subjected to h.f. fields. R.f. methods are unsuitable for low-loss materials, as the rate of heating depends upon the loss factor. The effects of variation in physical constants with changing temperature and of thermal conduction of the welding electrodes on the type of r.f. generator required are discussed. Generator design and typical oscillator circuits are considered.

621.318.2 **3452**

Permanent Magnets: Properties, Design, Materials.—J. Fischer. (*Arch. Elektrotech.*, Feb. 1949, Vol. 39, No. 5, pp. 327–340.)

621.318.22 **3453**

Anisotropic Permanent Magnet Alloys.—K. Hoselitz & M. McCaig. (*Nature, Lond.*, 1st Oct. 1949, Vol. 164, No. 4170, pp. 581–582.) Discussion of experimental determinations of some magnetic characteristics of Alcomax which confirm and extend the conclusions of Jellinghaus (*Z. für Metallkunde*, 1948, Vol. 39, p. 52) about domain magnetization, and explain the remarkable magnetic hardness of this type of alloy.

621.383.4 **3454**

Theory of Photoconductivity of Layers of Semiconducting Substances.—Schwarz. (*See* 3578.)

621.775.7 : 538.213 **3455**

Magnetic Properties of Iron Compacts in relation to Sintering Temperature.—R. Steinitz. (*J. appl. Phys.*, July 1949, Vol. 20, No. 7, pp. 712–714.) A paper presented at the International Powder Metallurgy conference noted in 753 of March. The relation between permeability and density for the higher sintering temperatures is discussed.

MATHEMATICS

517.93 : 531 **3456**

A Method of Equivalent Linearization for Non-Linear Oscillatory Systems with Large Non-Linearity.—C. A. Ludeke. (*J. appl. Phys.*, July 1949, Vol. 20, No. 7, pp. 694–699.) The method described is based partly on existing nonlinear theory and partly on experimental results. See also 156 of 1948 (Minorsky).

681.142 **3457**

More Differential Analyzer Applications.—A. C. Cook & F. J. Maginniss. (*Gen. elect. Rev.*, Aug. 1949, Vol. 52, No. 8, pp. 14–20.) Continuation of 3114 of 1945 (Maginniss).

681.142 **3458**

Electronic Calculating-Machine Development in Cambridge.—M. V. Wilkes. (*Nature, Lond.*, 1st Oct. 1949, Vol. 164, No. 4170, pp. 557–558.) The operation of EDSAC is explained with reference to the calculation of Airy's integral $Ai(-x)$. The machine could calculate 100 values in about 4 minutes. See also 2823 of October and 3459 below.

681.142 **3459**

Progress in High-Speed [digital] **Calculating Machine Design.**—M. V. Wilkes. (*Nature, Lond.*, 27th Aug. 1949, Vol. 164, No. 4165, pp. 341–343.) Report of a conference held at Cambridge to mark the completion of the EDSAC. See also 3448 of 1948 (Wilkes & Renwick) and 3458 above.

681.142 : 518.61 **3460**

Precise Solution of Partial Differential Equations by Resistance Networks.—G. Liebmann. (*Nature, Lond.*, 23rd July 1949, Vol. 164, No. 4160, pp. 149–150.) The accuracy of electrical analogue methods of solving equations, normally within about 1%–5%, may be greatly increased by using a process of successive approximation. Solutions of some equations have been obtained within 1 or 2 parts in 10^4.

681.142 : 621.3.016.352 **3461**

Stabilization of Simultaneous Equation Solvers.—Korn. (*See* 3348.)

517.392(083.74) **3462**

Tables of Generalized Sine- and Cosine-Integral Functions. [Book Review]—Publishers: Harvard University Press, Cambridge, Mass., 1949, 2 vols, 462 and 560 pp., $20.00. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, p. 1034.) Tables computed to 6 decimal places on the Automatic Sequence Controlled Calculator.

MEASUREMENTS AND TEST GEAR

620.178.3 : 621.396.69 **3463**

Theory of Vibration Testing.—O. Heymann. (*Frequenz*, July 1949, Vol. 3, No. 7, pp. 196–208.) A general solution is obtained for the motion of elastically supported particles with one degree of freedom. Various types of applied accelerating force are considered and their effects are discussed. Of all possible vibrations to which apparatus may be subjected, the periodic type is the most dangerous, particularly if the vibration period approaches the natural period of the apparatus in question. In this case, as in most other cases, the impulse given to the apparatus is a better index of strain than the actual acceleration. Suggestions for improved vibration tests are made.

621.317.321†: 621.314.2 **3464**

Method for the Direct Measurement of the Active and the Reactive Voltage Drop in Transformers.—F. Koppelmann. (*Arch. Elektrotech.*, Sept. 1948, Vol. 39, Nos. 2/3, pp. 164–183.) With the help of a moving-coil instrument preceded by a mechanical rectifier, both the resistive and inductive voltage drop of a transformer can be measured, not only on short-circuit but also under normal conditions of operation. The application of the method to a single-phase and to a 3-phase transformer is explained.

621.317.335.2† + 621.317.374] : 621.319.45 **3465**

Measurement of the Apparent Capacitance and the Loss Angle of Electrolytic Capacitors by the Three-Ammeter Method.—V. Aschoff. (*Arch. Elektrotech.*, April 1949, Vol. 39, No. 6, pp. 414–419.) A variable impedance is connected in parallel with the capacitor and adjusted till the currents in the two branches, due to an applied alternating voltage, are equal. The loss angle is then easily determined from the ratio of the main circuit current to that in either branch; simple formulae give the value and phase of the apparent resistance of the capacitor and also its apparent capacitance. Correction formulae are necessary if the meter resistances cannot be regarded as negligible.

621.317.335.3† : 621.315.612 **3466**

Method of Determining the Dielectric Constant and Power Factor of Ceramics at 100 Mc/s as a Function of Temperature.—H. J. Evans. (*J. Amer. ceram. Soc.*, 1st Aug. 1949, Vol. 32, No. 8, pp. 262–266.) A resonance method, using a specially constructed Q-meter. Temperature is varied by enclosing the whole equipment in an electric heater and Q is measured by the frequency-variation method. Typical results are shown graphically and discussed.

621.317.4 **3467**

Magnetic Testing Symposium features the 1948 A.S.T.M. Meeting.—(*Elect. Mfg*, Aug. 1948, Vol. 42, No. 2, pp. 121–125..220.) Summaries of 9 papers presented at the meeting.

621.317.44 **3468**

New Coil Systems for the Production of Uniform Magnetic Fields.—J. R. Barker. (*J. sci. Instrum.*, Aug. 1949, Vol. 26, No. 8, pp. 273–275.) Systems of three or four identical air-cored circular coils are described. The required separations of these coils and the currents in them are calculated with due allowance for the finite cross-section of the coils.

621.317.44 : 552.12 **3469**

A New High Sensitivity Remanent Magnetometer.—E. A. Johnson, T. Murphy & P. F. Michelsen. (*Rev. sci. Instrum.*, June 1949, Vol. 20, No. 6, pp. 429–434.) The instrument, constructed for use in a mobile field laboratory, is capable of measuring magnetic moments as small as 2×10^{-8} c.g.s. units per cm^3 in rock samples of volume 25–50 cm^3. Circuit and practical details are given.

621.317.44 : 621.318.24 **3470**

A Sensitive Balance for Stability Tests on Permanent Magnets.—S. F. Knight. (*Proc. Instn elect. Engrs*, Part II, Aug. 1949, Vol. 96, No. 52, pp. 635–640.) The force acting on a conductor in the field of the magnet is balanced against the weight of a fixed mass. An optical system is used to detect unbalance. Errors and their elimination are discussed. Typical test results indicate an overall maximum error of ±0.03%.

621.317.66 : 621.317.794.029.64 **3471**

Determination of Efficiency of Microwave Bolometer Mounts from Impedance Data.—D. M. Kerns. (*Bur. Stand. J. Res.*, June 1949, Vol. 42, No. 6, pp. 579–585.) The bolometer mount is regarded as a transducer which can be represented as a 2-terminal-pair network, and its parameters are determined from observation of input impedance as a function of bolometer resistance. Theory of the method is discussed and formulae are given for calculating the power-transfer efficiency from such impedance data.

621.317.7 + 621.38 + 621.396.69] : 061.4 **3472**

Electronic Equipment at Radiolympia, 1949.—(*Electronic Engng*, Oct. 1949, Vol. 21, No. 260, pp. 367–374.) Brief descriptions of various exhibits.

621.317.71 **3473**

A Precision Automatic Electrometer.—N. T. Seaton. (*Rev. sci. Instrum.*, July 1949, Vol. 20, No. 7, pp. 500–503.) For measuring currents of the order 10^{-11} to 10^{-14} A in terms of the time required to charge a capacitor to a certain voltage. Accuracy is within 0.1% when the input FP-54 pliotron is operated under special conditions; negative feedback is used.

621.317.72 : 621.314.63 **3474**

Rectifier-Voltmeters.—O. Macek. (*Frequenz*, July 1949, Vol. 3, No. 7, pp. 223–226.) Description of aperiodic and tuned voltage and field-strength meters for dm and cm waves, using Ge rectifiers. With a resistance of 100 kΩ in series with the indicating meter the calibration curve plotted on logarithmic paper is linear above 0.3 V. Rectifier sensitivity data for frequencies of 10 Mc/s and 7 000 Mc/s are tabulated.

621.317.725 **3475**

■ **New Type of High-Voltage Voltmeter for Absolute Measurements.**—B. Gänger. (*Arch. Elektrotech.*, 1949, Vol. 39, No. 7, pp. 443–452.) A plane circular electrode, held centrally in a gap in the face of a much larger guard-ring electrode by three insulated radial springs, moves outward slightly when a third electrode of opposite polarity is brought near. The motion causes a reduction of the capacitance of a parallel-plate capacitor connected mechanically to the electrode. This capacitance change is a measure of the applied voltage and causes variation of the frequency of a h.f. oscillator. Theory of the method is given and the construction and calibration of practical equipment is described.

621.317.725 **3476**

Reflex Valve Voltmeter.—M. G. Scroggie. (*Wireless World*, Oct. 1949, Vol. 55, No. 10, pp. 401–404.) An effective method of stabilization involves the addition of only one extra resistance to the simplest form of such a voltmeter. Operation for symmetrical square-wave input is described and calibration curves are given. A circuit diagram for such a voltmeter with ranges of 5 V, 20 V and 50 V is included.

621.317.725 **3477**

Arrangement for Indicating Small Direct Voltages with a Pen Recorder.—W. Geyger. (*Arch. elekt. Übertragung*, Aug. 1949, Vol. 3, No. 5, pp. 165–173.) The main features of other devices of the pen-recorder type hitherto available are reviewed. The essential components of the instrument described are a magnetic amplifier, a valve amplifier and a phase-sensitive rectifier whose output is applied to a moving-coil recorder and a compensating resistor. Voltages of the order of 0.1–1.0 mV can be measured to within 1%.

621.317.725 : 621.316.722.4 **3478**

Vacuum Capacitor Voltage Dividers.—E. F. Kiernan. (*Electronics*, Sept. 1949, Vol. 22, No. 9, pp. 140..146.) The a.c. range of a valve voltmeter can be extended and the input impedance can be simultaneously increased by using compact vacuum capacitors which can be assembled to form voltage dividers consisting of two sections in series.

621.317.734 **3479**

Valve Megohmmeter. — W. H. Cazaly. (*Wireless World*, Sept. 1949, Vol. 55, No. 9, pp. 326–328.) A true potentiometer circuit is used with a high-impedance valve-operated indicator. Accuracy is within about 2% for the range 5 kΩ–5 MΩ; readings are independent of battery voltage within wide limits. See also 153 of January (Spratt).

621.317.75 **3480**

A Direct Reading Pulse Length Meter and Shape Analyzer.—R. Rudin. (*Rev. sci. Instrum.*, July 1949, Vol. 20, No. 7, pp. 467–471.) An instrument designed to measure the duration of repeated current or voltage pulses, and to determine the form of the pulse by measuring the width at different heights. Comparison with other methods shows good agreement of the results.

621.317.761 : 513.618.1 **3481**

Frequency Comparison with Cycloids.—W. Bader. (*Arch. Elektrotech.*, Sept. 1948, Vol. 39, Nos. 2/3, pp. 115–129.) For the comparison of two frequencies within a wide range, epicycloids or hypocycloids are generated on the screen of a c.r.o. Comparatively large frequency ratios, either integral or fractional, can be identified quite easily. The direction of apparent rotation of the diagram seen on the screen, when the frequency ratio is near that which gives a stationary pattern, is an indication as to whether one of the frequencies is too high or too low. Complete theory of the method is given and numerous illustrations of actual patterns are included.

621.317.763 **3482**

Citizens Radio Wavemeter.—W. B. Lurie. (*Electronics*, Sept. 1949, Vol. 22, No. 9, pp. 88–91.) Two coaxial-type wavemeters are described. Formulae are given from which the impedance can be calculated, and the effect of distortion near the end plate is considered. Accuracy with typical component values is discussed; it may easily be made adequate for use with class-B equipment. Sufficient accuracy for use with class-A transmitters can be obtained with greater construction precision. Increased sensitivity can be obtained if a fixed capacitor is used to provide some of the loading capacitance. For other articles on Citizens' Radio see 517 of February (Samuelson), 1006 of April (Hollis) and back references.

621.317.772.029.3/.4 **3483**

Measuring Phase at Audio and Ultrasonic Frequencies.—E. R. Kretzmer. (*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 114–118.) The periodic signals to be compared are converted to square waves whose edges coincide with the points where the amplitudes of the original signals are zero. These square waves are used to form pulse trains which successively trigger a flip-flop circuit. The phase difference is read directly; it depends upon the average current through one side of the flip-flop circuit.

621.317.78 : 536.532 **3484**

Dynamic Impedance and Sensitivity of Radiation Thermocouples.—P. B. Fellgett. (*Proc. phys. Soc.*, 1st June 1949, Vol. 62, No. 354B, pp. 351–359.)

621.317.784 : 621.392 **3485**

Novel Multiplying Circuits with Application to Electronic Wattmeters.—El-Said. (*See* 3361.)

621.317.79 : 621.385.032.216 **3486**

A New Emission Microscope for Oxide Cathodes.—L. Jacob. (*J. sci. Instrum.*, Aug. 1949, Vol. 26, No. 8, pp. 262–266.) For investigating the spatial variation of emission over an oxide surface. The action of the microscope depends on the fact that the modulator of a conventional electron gun behaves like an iris diaphragm when its potential is varied. The modulator thus controls the area of emission on the cathode surface, and enables the variations which occur over small areas to be investigated. Effects at both high and low modulations are examined for an extensive oxide surface. The instability associated with temperature-limited emission is investigated for all points on the modulation characteristic.

621.317.79 : 621.396.615.12 **3487**

Audio Signal Generator: Parts 1 & 2.—M. G. Scroggie. (*Wireless World*, Aug. & Sept. 1949, Vol. 55, Nos. 8 & 9, pp. 294–297 & 331–334.) Details of an a.f. oscillator for general laboratory work, and discussion of auxiliary circuits and frequency calibration.

621.317.79 : 621.397.7 **3488**

A TV Monitor Receiver.—F. C. Grace. (*Communications*, Feb. 1949, Vol. 29, No. 2, pp. 10–13 . . 34.) A low-gain receiver to enable the transmitter operator to assess the quality of the picture being broadcast. Requirements additional to those of good home receivers are protection against overloading by strong signals and high discrimination against unwanted r.f. signals.

621.385.001.4 **3489**

Modern Test Methods revealing the Characteristics and Limitations of V.H.F. and U.H.F. Valves.—R. Remillon. (*Onde élect.*, July & Aug./Sept. 1949, Vol. 29, Nos. 268 & 269/270, pp. 273–285 & 336–346.) A review of the tests which should be carried out by valve manufacturers to give users the necessary information for predicting the operation of any particular valve under given conditions, and for indicating the limitations of the use of normal valves at v.h.f. The following classes of valves are considered: (*a*) receiving or low-power transmitting valves, miniature and acorn valves; (*b*) v.h.f. transmitting triodes, tetrodes or pentodes used in circuits with localized constants or with Lecher transmission lines; (*c*) v.h.f. and u.h.f. transmitting triodes and tetrodes used with cavity-resonator circuits; (*d*) klystrons and travelling-wave valves; (*e*) magnetrons.

621.396.933.001.4 **3490**

The Maintenance of Aircraft Radio Equipment.—(*Engineering, Lond.*, 12th Aug. 1949, Vol. 168, No. 4359, p. 164.) Brief description of a Marconi test set comprising a wide-range signal generator, a beat-frequency oscillator, a.f. power meter and apparatus including a loop and a vertical aerial for testing d.f. equipment. The set is intended primarily for use at main service depots where an adequate supply of spare units is available. For transmitter testing, additional modulator, power and loading units are required.

531.761 **3491**

Electronic Time Measurements. [Book Review]—B. Chance, R. I. Hulsizer, E. F. MacNichol, Jr, & F. C. Williams (Eds). Publishers: McGraw-Hill, New York and London, 1949, 538 pp., 42s. (*Nature, Lond.*, 8th Oct. 1949, Vol. 164, No. 4171, pp. 594–595.) Vol. 20 of the M.I.T. Radiation Laboratory series. The book is really a sequel to that noted in 2006 of July, and "describes some very ingenious circuit developments originated both in Great Britain and in the United States". Subjects covered include electronic integrators, accurate time measurements connected with the navigation aids Gee and Oboe, automatic following of radar responses, methods of relaying an airborne p.p.i. picture to a ground station, etc.

621.317.2 **3492**

Radio Laboratory Handbook. [Book Review]—M. G. Scroggie. Publishers: Iliffe & Sons, London, 4th edn 1948, 424 pp. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, p. 1036.) Intended to guide a laboratory worker in setting up and properly using a laboratory. Commercially available British laboratory instruments and a few special instruments are described, and general methods of measurement considered.

OTHER APPLICATIONS OF RADIO AND ELECTRONICS

531.717.1 : 539.16.08 **3493**

Radioactive Thickness Gage for Moving Materials.—J. R. Carlin. (*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 110–113.) Material moving between an ionization chamber and a radioactive source absorbs β-particles or γ-rays in proportion to its thickness. A meter in the electrometer amplifier circuit can be calibrated to read thickness directly.

535.61-15 **3494**

A New Industrial Infra-Red Spectrometer.—R. R. Gordon, H. Powell & R. A. C. Isbell. (*J. sci. Instrum.*, Aug. 1948, Vol. 25, No. 8, pp. 277–282.) A detailed description. Results obtained with two instruments of this design on three hydrocarbons are compared with those obtained with earlier instruments, and calibration problems are considered.

539.16.08 **3495**

Characteristics of Halogen Counters.—S. H. Liebson. (*Rev. sci. Instrum.*, July 1949, Vol. 20, No. 7, pp. 483–484.)

539.16.08 **3496**

A Demountable Geiger-Muller Counter using Filling Gases at Atmospheric Pressure.—J. F. Tait & G. H. Haggis. (*J. sci. Instrum.*, Aug. 1949, Vol. 26, No. 8, pp. 269–271.) For the assay of tracers emitting low-energy β-rays. A helium/ether mixture flows through the counter.

539.16.08 **3497**

A Circuit for the Study of the Operation of the Geiger-Müller Counter.—M. A. Guimarães & P. A. Sampaio. (*Rev. sci. Instrum.*, July 1949, Vol. 20, No. 7, pp. 485–488.)

539.16.08 **3498**

Portable Geiger Counter for Drill Holes.—A. Roberts. (*Radio & Televis. News, Radio-Electronic Engng Supplement*, Sept. 1949, Vol. 13, No. 3, pp. 16–17 . . 28.) For detecting radioactivity at depths down to 1 000 ft. The counting apparatus is fixed on the side of a cable drum; a single-ended self-quenching G-M tube, without preamplifier, is attached to the free end of the cable. Circuit and component details are given.

539.16.08 : 621.318.572 **3499**

Electronic Counters for Pulses.—Naslin & Peuteman. (*See* 3357.)

551.508 : 621.316.86 **3500**

Thermistors as Instruments of Thermometry and Anemometry.—Hales. (*See* 3355.)

551.508.1 : 621.396.9 **3501**

A Dutch Radiosonde.—J. L. van Soest. (*Tijdschr. ned. Radiogenoot.*, Oct. 1940, Vol. 8, Nos. 4/5, pp. 305–313. In Dutch.) Description of apparatus for transmitting to a ground station information concerning air pressure, temperature and humidity. A rotary switch, operated by a small $\frac{3}{4}$-W motor, provides a system of coded signals on a carrier frequency of 50 Mc/s.

620.179.14 : 625.17 **3502**

Railroad Track Inspection Car.—R. D. Walker, Jr. (*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 66–68.) The car is self-propelled and has a special generator which passes large currents at low voltage through the rails. Any flaw, such as a transverse crack, produces a characteristic variation of the flux through search coils at the mid-point of the equipment. Such variations are used to provide an indication of the location of the flaw on the tape of a recorder. Inspection is carried out at about 12 m.p.h. A sensitive hand set is provided for detailed examination of suspected flaws.

621.316.7.078 **3503**

Planning for Automatic Process Control.—(*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 72–79.) Discussion of the general principles of various types of control device and their relative merits, typical sensing elements, automatic controllers and correcting devices. For various applications in heavy and light industries, brief details are given of the type of equipment used; illustrative diagrams of typical installations are included.

621.317.39 : 531.391 : 531.15 **3504**

Rotor Balancing with an Electronic Capacitor Gauge.—H. D. Warshaw. (*Rev. sci. Instrum.*, July 1949, Vol. 20, No. 7, pp. 474–476.) A variable air-gap capacitance exists between an unbalanced rotating member and a stationary plate. Variations of the air-gap are used to modulate the output of an oscillator; this output is displayed on a c.r.o. Cyclic displacements of 0.000 5 in. at the circumference of the rotor are easily detected, and can be located by means of a contactor on the rotor shaft.

621.365.54† **3505**

The Heating of Materials of Low Conductivity by H.F. Induction Currents.—G. Ribaud. (*J. Phys. Radium*, April 1947, Vol. 8, No. 4, pp. 97–101.) Graphs are given from which the efficiency of heating can be calculated for various substances. With frequencies of the order of 1 Mc/s, excellent efficiencies can be obtained with materials of resistivity from 10^7 to 10^{10} c.g.s. units and of dimensions exceeding 6 cm.

621.38.001.8 **3506**

Institution of Electronics (N.W. Branch). Fourth Annual Exhibition.—H. Steeple. (*Nature, Lond.*, 24th Sept. 1949, Vol. 164, No. 4169, pp. 525–526.) Brief descriptions of various exhibits. See also 3219 of November.

621.38.001.8 : 621.9 **3507**

Electronic Control of Machine Tools.—S. A. Ghalib. (*Engineering, Lond.*, 19th Aug. 1949, Vol. 168, No. 4360, pp. 173–174.) Long summary of paper presented at a joint meeting of the British Institution of Radio Engineers and the Institution of Production Engineers. Electronic applications for machine tools are mainly to (*a*) variable-speed drives, (*b*) feed control, (*c*) automatic machining of a given profile. See also 1449 of May.

621.384.611.2† **3508**

A Resonance Effect in the Synchrotron.—E. D. Courant. (*J. appl. Phys.*, June 1949, Vol. 20, No. 6, pp. 611–616.) Resonance effects occurring when $n = d(\log H)/d(\log r) = \frac{3}{4}$ will reduce the intensity of the beam if the first Fourier component of the azimuth variation of n exceeds about 10^{-3}, unless the equilibrium value of n is sufficiently far from $\frac{3}{4}$.

621.384.611.2† **3509**

Three-Dimensional Design of Synchrotron Pole-Faces.—C. Robinson. (*Proc. phys. Soc.*, 1st Sept. 1949, Vol. 62, No. 375A, pp. 592–597.) An analytical method is outlined which takes full account of the cylindrical symmetry. Relaxation methods are used (*a*) to determine the exact size and shape of the lips to correct for fringing, (*b*) to check the characteristics of the magnetic field. Practical examples are included.

621.385.833 **3510**

Field Asymmetry due to the Voltage Feeders for Electrostatic Lenses.—F. Bertein. (*C. R. Acad. Sci., Paris*, 25th July 1949, Vol. 229, No. 4, pp. 291–293.)

621.385.833 **3511**

The Illuminating System of the Electron Microscope.—J. Hillier & S. G. Ellis. (*J. appl. Phys.*, July 1949, Vol. 20, No. 7, pp. 700–706.)

621.385.833 **3512**

The Scanning Principle in Ultra-Microscopy.—H. Mahl. (*Elektron Wiss. Tech.*, Sept. 1949, Vol. 3, No. 9, pp. 350–354.) Short description of three types of microscope using secondary emission. The first, due to Knoll (1157 of 1936), gives an image directly on the screen of a c.r. tube. In the second, due to v. Ardenne (1667 of 1939), the image is recorded on a photographic film, while that of Zworykin, Hillier & Snyder (139 of 1943) makes use of a facsimile printer.

621.385.833 : 061.3 **3513**

Conference on Electron Microscopy, Delft.—V. E. Cosslett. (*Nature, Lond.*, 17th Sept. 1949, Vol. 164, No. 4168, pp. 481–483.) A general account of the proceedings, with abstracts of selected papers.

621.396.9 : 674 **3514**

Metal Detector for the Lumber Industry.—C. R. Schafer. (*Electronics*, Sept. 1949, Vol. 22, No. 9, pp. 100–103.) A 4-coil arrangement designed to provide more uniform sensitivity to objects embedded in logs at various angles. Complete circuit diagrams with component values and coil winding data are included. See also 3212 of 1948 (Hacks).

621.398 : 623.41 **3515**

Study and Realization of Electronic Telecontrol of Artillery.—R. Aubry ; G. Lehmann ; H. Le Boiteux. (*Onde élect.*, Aug./Sept. 1949, Vol. 29, Nos. 269/270, pp. 311–329.) Part 1 : "History of the Subject and Statement of the Problem." The conditions which must be satisfied by equipment for naval vessels and the reasons which led the naval authorities to investigate electronic methods are considered. An outline of the development of suitable equipment is given.

Part 2 : "Principles and Methods which have served as a Basis for Study." The theory of servomechanisms is applied to the determination of the cut-off frequency for a given precision of response and given conditions of stability. The essential characteristics of the output stage and the effects of filter inductance and motor inertia are considered and also the design of correcting networks.

Part 3 : "Description of Equipment. Results Obtained." Details are given of the methods and apparatus finally adopted for gun control. Records show that considerably higher accuracy of setting was achieved than was originally specified; the stability of the system was excellent.

621.38.001.8 **3516**

Electronics and their Application in Industry and Research [Book Review]—B. Lovell (Ed.). Publishers : Pilot Press, 1947 ; now issued by Chapman & Hall, London, 660 pp., 42s. (*Electronic Engng*, Oct. 1949, Vol. 21, No. 260, pp. 396–398.) ". . . a long, soundly written, soundly edited account of recent developments, written by leading specialists. Much of it appears for the first time in book form, including many useful practical data . . . This book can be strongly commended to all electronic engineers and to others who would gain a wider view of the possibilities of electronics, as it combines to an uncommonly high degree the virtues of scientific authority and compact, interesting presentation." Each chapter is self-contained and has an up-to-date bibliography.

PROPAGATION OF WAVES

538.566.2 : 512.9 **3517**

Tensor Field Equations in a Region of Variable Refractive Index.—P. D. P. Smith. (*J. appl. Phys.*, June 1949, Vol. 20, No. 6, p. 633.)

538.566.3 : 551.510.535 **3518**

Propagation of Electromagnetic Waves in a Layered Medium under the Influence of a Magnetic Field, for Oblique Incidence.—K. Försterling. (*Arch. elekt. Übertragung*, July 1949, Vol. 3, No. 4, pp. 115–120.) The differential equations for the propagation of e.m. waves in the ionosphere are developed and their solution, as affected by the earth's magnetic field, is discussed.

538.566.3 : 551.510.535 **3519**

Some Remarks on the Ionospheric Double Refraction : Part 1.—H. Bremmer. (*Philips Res. Rep.*, Feb. 1949, Vol. 4, No. 1, pp. 1–19.) General theory is discussed, with special reference to s.w. propagation. Snell's law determining the normal direction of propagation is given explicitly; the connection between this direction and that of the corresponding ray is derived (*a*) from the mathematical theory of the characteristic surfaces of a partial differential equation, (*b*) by considering Fresnel's indicial surface, (*c*) from Fermat's principle, (*d*) from the Poynting vector. For a given primary ray, the splitting into an ordinary and an extraordinary ray on reaching the ionosphere and the state of polarization on leaving it are investigated. The corresponding theory for long waves is summarized and illustrated by a numerical example.

621.396.11 : 551.510.52 **3520**

Tropospheric Measurements.—P. Harbury. (*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 126, 128.) Description of a 106-Mc/s 100-kW pulse transmitter using a parabolic reflector 62 ft in diameter, which radiates vertically, and the associated recording system. The apparatus will be used to continue and extend the work of Friend noted in 2593 of 1948 and 1760 of June.

621.396.11 : 551.510.535 **3521**

Ionospheric Absorption.—R. N. Bracewell & K. Weekes. (*J. appl. Phys.*, July 1949, Vol. 20, No. 7, p. 724.) Criticism of 2027 of July (McCracken).

621.396.11 : 551.510.535 : 061.3 **3522**

The Ionosphere and the Propagation of Radio Waves.—J. A. Ratcliffe. (*Nature, Lond.*, 24th Sept. 1949, Vol. 164, No. 4169, pp. 511–513.) Report of a Summer Meeting of the Physical Society at Cambridge, held to survey and co-ordinate research work in progress.

621.396.11.029.58 **3523**

Investigations of High-Frequency Echoes : Part 2.—H. A. Hess. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, pp. 986–989.) Continuation of 3495 of 1948. Records of telegraphy signals at frequencies between 10 and 20 Mc/s which show periodic variations of the field strength are investigated. See also 2608 of September.

621.396.11.029.62 : 621.396.1 **3524**

The Ad Hoc Committee Report.—R. Lewis. (*Communications*, July 1949, Vol. 29, No. 7, pp. 6–9, 30.) Report of a study of propagation problems for f.m. and television transmissions at frequencies between 50 and 250 Mc/s, providing data for frequency channel allocation.

Four main objectives are considered: (*a*) prediction of service field intensities, taking into account standard ground-wave signal range curves, effective aerial heights, and correction factors based on experimental results, (*b*) evaluation of random terrain variation, (*c*) tropospheric propagation curve evaluation, (*d*) the general principles involved in combining the effects of variations of the desired signal and one or more interfering signals. Further investigation of (*d*) is required.

621.396.81 : 621.397.5 **3525**

Technique for TV Field Surveys.—J. F. Dreyer, Jr. (*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 82–85.) Circumferential as well as radial measurements should be taken, and aerials at heights of both 10 ft and 30 ft should be available. In hilly country or built-up areas the ratio of the signal strength at 30 ft to that at 10 ft may be much less than 3 : 1.

621.396.81 : 621.397.5 **3526**

Field Test of U.H.F. Television [near Washington].—J. Fisher. (*Electronics*, Sept. 1949, Vol. 22, No. 9, pp. 106–111.) See also 1480 of May (Brown).

621.396.81 : 621.397.5 **3527**

Multipath Television Reflections.—E. G. Hills. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, pp. 1043–1046.) A formula is derived for the strength of reflected television signals at the receiver, and certain types of reflecting area are considered in order to discover why the direction of arrival of such signals depends on frequency. An aerial arrangement that appears to be particularly useful for reducing the effects of such reflections is described.

538.566 + 621.396.11 **3528**

Radio Wave Propagation. [Book Review]—Committee on Propagation of the National Defense Research Committee. Publishers: Academic Press, New York, 1949, 511 pp. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, p. 1036.) Effects at frequencies above 30 Mc/s are considered. Theoretical and practical aspects of standard propagation, non-standard propagation, diffraction, coverage, radio meteorology, absorption, scattering, echoes, are among the subjects covered. Wartime reports by 45 or more authors in various parts of the world are included.

RECEPTION

621.396.621 **3529**

F.M. Receivers with Supersonic Control.—F. M. Berry. (*Communications*, Aug. 1949, Vol. 29, No. 8, pp. 12–14.) Control signals are used to enable a f.m. broadcaster to turn on or off specified groups of receivers, or to change the strength of signal transmitted to them. The control signals actuate locking circuits or switch out attenuator pads.

621.396.621 **3530**

Eddystone Model 680.—(*Wireless World*, Sept. 1949, Vol. 55, No. 9, pp. 335–338.) Test report on a 15-valve superheterodyne general-purpose receiver for the frequency range 480 kc/s–30 Mc/s.

621.396.621 : 338.585.8 **3531**

Reducing Costs in Receiver Manufacturing.—S. A. Tucker. (*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 86–93.)

621.396.621 : 621.396.619.11/.13 **3532**

On Theoretical Signal-to-Noise Ratios in F.M. Receivers: A Comparison with Amplitude Modulation.—D. Middleton. (*J. appl. Phys.*, July 1949, Vol. 20, No. 7, p. 724.) Corrections to 2619 of September.

621.396.621 : 621.396.619.11 **3533**

More on the Synchrodyne.—D. G. Tucker & J. F. Ridgway. (*Short Wave Mag.*, Dec. 1947, Vol. 5, No. 10, pp. 598–601.) Abridged version of articles abstracted in 525 and 526 of 1948.

621.396.621 : 621.396.619.13 : 621.396.813 **3534**

Harmonic Distortion in Frequency-Modulation Off-Resonance Discriminator.—A. R. Vallarino & M. S. Buyer. (*Elect. Commun.*, June 1949, Vol. 26, No. 2, pp. 167–172.) The discriminator is assumed to consist of a single tuned circuit with a detector preceded by one or two limiters. The percentage nonlinearity and percentage distortion are shown graphically in terms of a parameter involving (*a*) the difference between the carrier frequency and the resonance frequency of the tuned circuit and (*b*) the width of the resonance curve at the 3-db level.

621.396.621.029.58 **3535**

Simultaneous Reception of [signals from] **Several Stations on a Single Aerial.**—C. T. F. van der Wijck. (*Tijdschr. ned. Radiogenoot.*, March 1941, Vol. 8, No. 6, pp. 365–393. In Dutch.) Description of suitable receiver circuits, their filters and transformers, with details of equipment for reception in the bands 13.5–20.5 Mc/s and 6.5–13.5 Mc/s.

621.396.621.54 **3536**

The Ultimate in Converters.—J. E. Stacy. (*CQ*, Sept. 1949, Vol. 5, No. 9, pp. 13–20 . . 80.) A converter with remarkable performance at v.h.f. is obtained by adding a triode mixer and a Clapp oscillator to the low-noise amplifier circuit described in 3061 of 1948 (Wallman, Macnee & Gadsden).

621.396.822 : 523.72 **3537**

On the Origin of Solar Radio Noise.—Haeff. (*See* 3412.)

621.396.828 **3538**

How VOA Combats Jamming.—G. Q. Herrick. (*Electronics*, Sept. 1949, Vol. 22, No. 9, pp. 82–84.) The predistorter and peak limiter described accentuate speech intelligibility when multiple use of frequencies causes jamming.

STATIONS AND COMMUNICATION SYSTEMS

621.395.44 **3539**

Twelve-Channel Carrier Telephone Systems in South Africa.—N. J. Paola, C. F. Boyce & I. C. Ramsay. (*Trans. S. Afr. Inst. elect. Engrs*, Oct. 1948, Vol. 39, Part 10, pp. 277–312. Discussion, pp. 313–316.) Cross-talk, noise, power supplies and problems encountered in the planning, installation and maintenance of these systems. See also 2610 of 1948 (Retief & Barker).

621.395.44 : 621.315.052.63 **3540**

Telecommunications at High Frequency.—A. Latreille & M. Zweguintzow. (*Rev. gén. Élect.*, Sept. 1949, Vol. 58, No. 9, pp. 349–356.) Discussion of systems suitable for use on h.v. power networks. Single-frequency, dual-frequency and single-sideband equipment made by the Henry Lepaute Company and h.f. autocommutator equipment made by the Association des Ouvriers en Instruments de Précision are described and illustrated.

621.395.664.1 **3541**

Voice-Controlled Intercom System.—J. R. Cooney. (*Electronics*, Sept. 1949, Vol. 22, No. 9, pp. 118 . . 140.) Operation is similar to that of the conventional master/substation system, except that when the operator at the master station speaks above a certain low threshold level, an amplifier is automatically switched on to transmit his words, and switched off when he stops speaking.

621.396.1 : 621.396.11.029.62 **3542**

The Ad Hoc Committee Report.—Lewis. (*See* 3524.)

621.396.41 **3543**

Systems of U.S.W. Multichannel Telephony.—W. Klein. (*Bull. schweiz. elektrotech. Ver.*, 21st Aug. 1948, Vol. 39, No. 17, pp. 571–588. In German, with French summary.) The development of beam telephony in Switzerland and abroad is traced and the special characteristics of the different multichannel systems are reviewed, with particular reference to apparatus technique and to transmission properties. The choice of the best system for a specific service is still an open question. Points of particular interest, such as the optimum wavelength range or the conditions required for linearity of a transmission channel, are studied in detail. Under certain practical assumptions, a formula is deduced for the mean power necessary per channel. Values of this mean power are calculated, as a function of the number of channels, for the different systems. The conditions in Switzerland are particularly suitable for the establishment of such systems between high-altitude stations. See also 546 of 1948 (Gerber & Tank).

621.396.41 **3544**

Some Development Work in connection with U.S.W. Multichannel Communications in Switzerland.—G. Guanella. (*Bull. schweiz. elektrotech. Ver.*, 2nd Oct. 1948, Vol. 39, No. 20, pp. 678–688. In German, with French summary.) Describes experiments by Brown, Boveri & Co. on u.s.w. multicarrier systems, on systems using a single carrier and on modulated pulse systems.

621.396.41 : 621.392.52 **3545**

Significance and Application of Frequency Filters in U.S.W. Multichannel Systems.—F. Staub. (*Bull. schweiz. elektrotech. Ver.*, 18th Sept. 1948, Vol. 39, No. 19, pp. 627–635. In German, with French summary.) By the use of frequency-selector filters, whatever the system of modulation, a very great number of channels can be obtained while keeping the expenditure of energy in each speech channel within reasonable limits, maintaining a favourable ratio between the transmitter energy and that radiated, and ensuring as far as possible reliability of operation. The design of suitable filters is discussed, their characteristics are described and actual filters, with their impedance transformers, are illustrated and performance figures given.

621.396.41 : 621.396.65 **3546**

A Time-Sharing System of Multiplex.—H. D. B. Kirby. (*Electronic Engng*, Oct. 1949, Vol. 21, No. 260, pp. 360–365.) About 4 samples per cycle must be transmitted for each channel, making about 250 000 samples/sec for a 25-channel system, including synchronizing pulses. Connection of each channel to the transmitting equipment is achieved by means of a number of on/off switches. Block diagrams of the transmitter and receiver are given, and waveform diagrams for various parts of the transmitter and receiver are discussed. Radio links of this type are operating satisfactorily in Holland, South Africa and Czechoslovakia.

621.396.619 **3547**

Comparison of Signal/Noise Ratios of Modulation Arrangements.—W. Runge. (*Arch. elekt. Übertragung*, Aug. 1949, Vol. 3, No. 5, pp. 155–159.) A method of expressing signal/noise ratios in terms of two parameters is explained and applied to various modulation systems. The ratios are tabulated for single-sideband systems with carrier suppression, double-sideband systems with carrier, f.m., and pulse-phase, pulse-amplitude, pulse-time and pulse-code modulation. See also 3552 below.

621.396.619.13 **3548**

Application of Negative Feedback to Frequency-Modulation Systems.—P. F. Panter & W. Dite. (*Elect. Commun.*, June 1949, Vol. 26, No. 2, pp. 173–178.) A general formula for the output voltage in terms of the applied voltage is derived for a nonlinear network with feedback. For a f.m. transmitter, feedback will reduce distortion provided that a limiter is used in the feedback path. For a receiver, a limiter is required before the discriminator to obtain constant output. Inverse feedback reduces the required bandwidth of the i.f. amplifier without sacrificing the advantage of wide-band f.m.

621.396.619.13 **3549**

Recent Developments concerning Frequency Modulation.—T. J. Weijers. (*Tijdschr. ned. Radiogenoot.*, Oct. 1940, Vol. 8, Nos. 4/5, pp. 315–364. In Dutch.) A comprehensive discussion dealing with the response of a linear network to a f.m. signal, various methods of detection, the balanced detector, amplitude limiting and the use of feedback in f.m. receivers, effects of interference and noise, and interference from a neighbouring transmitter on the same frequency. The relative merits of a.m. and f.m. for medium and for short waves are summarized.

621.396.619.16 **3550**

Note on the Theoretical Efficiency of Information Reception with P.P.M. [pulse position modulation].—M. J. E. Golay. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, p. 1031.)

621.396.619.16 **3551**

Equipment for Interference-Free Long-Distance Electrical Communications.—F. Schröter. (*Arch. elekt. Übertragung*, July/Aug. 1947, Vol. 1, Nos. 1/2, pp. 2–13.) Description of a pulse-code system in which signal amplitudes are converted into pulse groups in the transmitter by means of an electro-optical system including a c.r. tube and a screen with graded sets of perforations. In the receiver the process is reversed, the deflection of the beam in the c.r. tube being synchronized with that in the transmitter.

621.396.619.16 **3552**

Noise Factor for Communication by Code Modulation.—E. Kettel. (*Arch. elekt. Übertragung*, Aug. 1949, Vol. 3, No. 5, pp. 161–164.) The effect of noise in producing signal imperfections in pulse-code modulation systems is discussed. Signal/noise ratios for pulse-code, pulse-phase and frequency modulation are calculated from Runge's formulae (3547 above) and compared.

621.396.932 **3553**

R.M.S. Caronia Radio and Electronic Installation.—(*Elect. Commun.*, June 1949, Vol. 26, No. 2, pp. 107–128.) Detailed account of the equipment briefly noted in 1799 of June.

621.394/.395 : 621.316.975 **3554**

Earth Conduction Effects in Transmission Systems. [Book Review]—E. D. Sunde. Publishers: D. Van Nostrand, New York, 1949, 360 pp., $6.00. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, p. 1034.) Fundamental methods for the analysis of such effects and the basic principles underlying devices for protection against the resultant circuit disturbances are discussed. " . . . This book is the first of its kind, covering a difficult field very well and filling a need long neglected."

SUBSIDIARY APPARATUS

621.316.722.1 **3555**

Voltage Stabilizers: Parts 1-4.—F. A. Benson. (*Electronic Engng*, May–Aug. 1949, Vol. 21, Nos. 255–258, pp. 155–158, 200–203, 243–247 & 300–302.) A review of various methods of stabilization for both a.c. and d.c. power supplies. Circuits including magnetically-saturated elements are considered as well as those using gaseous discharge valves. Characteristics of available valves and their limitations are discussed. Several valve circuits found useful in practice are described, with due reference to the performance to be expected. The treatment is non-mathematical, except for an appendix on valve-circuit theory.

621.396.682 **3556**

A D.C. Stabilized Power Supply of Low Impedance.—V. H. Attree. (*J. sci. Instrum.*, Aug. 1948, Vol. 25, No. 8, pp. 263–268.) A full-wave rectifier with a single-stage Π filter followed by a series power valve. Output impedance is $< 2\ \Omega$ at all frequencies up to 100 kc/s or more. For load currents of 0–90 mA the output is 400 V, with variations of 200 mV.

TELEVISION AND PHOTOTELEGRAPHY

621.397.26 **3557**

New Methods of Rapid Phototelegraphy.—F. Schröter. (*Bull. schweiz. elektrotech. Ver.*, 11th Dec. 1948, Vol. 39, No. 25, pp. 819–827. In German, with French summary.) Cathode-ray tubes are used for scanning and reproducing the pictures to be transmitted. The screen of the transmitter tube has very little persistence, while the receiving screen is highly persistent. Fidelity and image sharpness are secured by correction of distortion, automatic compensation of the field curvature and automatic focusing. Using a 1 200-line sweep, a picture 20 cm × 14 cm can be transmitted on any type of wide-band system in about 1 sec.

621.397.26 : 621.394 **3558**

Facsimile Transceiver for Pickup and Delivery of Telegrams.—G. H. Ridings. (*Elect. Commun.*, June 1949, Vol. 26, No. 2, pp. 129–137.) Description of the Western Union Telefax system.

621.397.331.2 : 535.517.25 **3559**

Asymmetrical-Aperture Scanning in Television.—Ya. A. Ryftin. (*Zh. tekh. Fiz.*, July 1949, Vol. 19, No. 7, pp. 804–821. In Russian.) A new scanning method which increases image sharpness by about 85% and more than doubles the 'quality of transmission'. No increase of bandwidth is required, but the resolving power of the camera must be increased. See also 1785 of 1948.

621.397.5 : 061.3 **3560**

The Paris Television Congress.—(*J. Televis. Soc.*, Dec. 1948, Vol. 5, No. 8, pp. 238–244.) Summaries of papers noted in 865 of March.

621.397.5 : 535.88 : 532.62 **3561**

Large-Screen Television and the Eidophor Process.—H. Thiemann. (*Télévis. franç.*, Aug. 1949, No. 50, pp. 6–10, 37.) See also 296 of 1948.

621.397.5 : 535.88 : 621.385.832 **3562**

On the Suitability of the Cathode-Ray Tube with Fluorescent Screen for Television Projection in Cine-Theatres.—F. Fischer. (*Bull. schweiz. elektrotech. Ver.*, 24th July 1948, Vol. 39, No. 15, pp. 468–480. In German, with French summary.) The luminous intensity required for large-screen projection is discussed. The luminous efficiency of fluorescent substances at present available has almost reached the theoretical upper limit. The construction of fluorescent screens to furnish maximum light for a given definition of the image, and possible means of developing still greater luminous intensities, are considered.

621.397.5 : 621.396.81 **3563**

Field Test of U.H.F. Television.—Fisher. (*See* 3526.)

621.397.5 : 621.396.81 **3564**

Multipath Television Reflections.—Hills. (*See* 3527.)

621.397.5 : 621.396.81 **3565**

Technique for TV Field Surveys.—Dreyer. (*See* 3525.)

621.397.5(083.74) **3566**

Present-Day Television Standards in the U.S.A.—W. Reichel. (*Arch. elekt. Übertragung*, Aug. 1949, Vol. 3, No. 5, pp. 175–181.)

621.397.5(083.74) **3567**

Progress toward International TV Standards.—D. G. Fink. (*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 69–71.) At the first meeting of the 11th Study Group of the C.C.I.R., substantially unanimous agreement was reached that (*a*) the aspect ratio should be 4 units horizontally to 3 units vertically, (*b*) interlacing should be adopted, using the two-to-one odd-line method, (*c*) vertical scanning should be independent of the frequency of the power system. Further study is needed for determining suitable regional or world-wide standards for the number of lines per frame, number of frames per second, channel width and related quantities; existing national standards for these quantities vary considerably.

621.397.62 **3568**

Converters for U.H.F. Television Reception.—D. K. Reynolds & M. B. Adams. (*Electronics*, Sept. 1949, Vol. 22, No. 9, pp. 92–96.) Designed to cover the 475–890-Mc/s band with an i.f. of 250 Mc/s, the local oscillator tuning range being 271–680 Mc/s. This tuning range is obtained with a circuit including a semi-butterfly oscillator, a tap-switch oscillator and a cylinder oscillator. A crystal mixer is used because of its low noise figure at the required frequencies. This mixer consists essentially of a rolled-up parallel-strip transmission line. Parallel-line and coaxial-cavity types of mixer are suitable for fixed-tuned converters.

621.397.62 : 535.88 : 621.397.335 **3569**

Projection-Television Receiver : Part 5 — The Synchronization.—J. Haantjes & F. Kerkhof. (*Philips tech. Rev.*, June 1949, Vol. 10, No. 12, pp. 364–370.) Part 4 : 2934 of October.

621.397.621 **3570**

Anastigmatic Yoke for Picture Tubes.—K. Schlesinger. (*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 102–107.) 1949 I.R.E. Convention paper noted in 1810 of June [No. 85]. Loss of picture detail at the corners of large c.r. tubes is caused primarily by spot or deflection defocusing. It can be corrected by means of a deflection yoke that provides deflection fields which increase with distance from the tube axis. Such a yoke introduces only a tolerable amount of barrel distortion. Correction is easier for tubes with magnetic deflection than for those with e.s. deflection. A two-dimensional theory of deflection-coil astigmatism is explained and practical correction arrangements based on this theory are described.

621.397.7 **3571**

WOR-TV F.M.—F. J. Bingley. (*Electronics*, Sept. 1949, Vol. 22, No. 9, pp. 70–81.) Description of the television transmitter, associated terminal equipment to enable television pictures to be brought to the transmitter, and of an associated f.m. broadcast transmitter. An 810-ft tower supports both the television and f.m. aerials.

621.397.7 : 621.317.79 **3572**

A TV Monitor Receiver.—Grace. (*See* 3488.)

621.397.7.001.4 : 621.397.61 **3573**

TV Site Testing and Measurement Techniques.—E. S. Clammer. (*Communications*, June 1949, Vol. 29, No. 6, pp. 6–9.) A pulse transmitter whose power output is about equal to that of the proposed television station is used. Field intensities and the position of objects producing echoes are observed. A helicopter provides the best means of supporting the test aerial and transmitter. The transmitting and mobile receiving equipment used is described and typical results are discussed; adequate qualitative data can be obtained to determine correctly whether good, mediocre or unsatisfactory service would be given.

621.397.82 **3574**

The Character of Interference Patterns in Television.—G. G. Gouriet. (*J. Televis. Soc.*, Dec. 1948, Vol. 5, No. 8, pp. 235–237.) Diagonal patterns are caused by the presence of an interfering carrier signal whose frequency is within the vision frequency band. The change in these patterns with variation of the interfering frequency is analysed.

621.383 + 621.397 **3575**

Photoelectricity and its Applications. [Book Review]—Zworykin & Ramberg. (*See* 3599.)

TRANSMISSION

621.396.61 : 621.316.726 **3576**

Instantaneous Deviation Control.—M. R. Winkler. (*Electronics*, Sept. 1949, Vol. 22, No. 9, pp. 97–99.) The audio signal of a f.m. transmitter is differentiated, amplified until at a level suitable for clipping, clipped by a pair of biased diodes, and integrated so that the output wave is identical with the input wave except for slope limiting. Transmitter frequency deviations are held within definite limits determined by the maximum allowable slope.

VALVES AND THERMIONICS

537.533 **3577**

Electron Beams of High Current-Density in Electrostatic Fields.—H. Huber & W. Kleen. (*Arch. Elektrotech.*, April 1949, Vol. 39, No. 6, pp. 394–414.) Detailed theory and discussion with special reference to the design of electron guns.

621.383.4 **3578**

Theory of Photoconductivity of Layers of Semiconducting Substances.—E. Schwarz. (*Proc. phys. Soc.*, 1st Aug. 1949, Vol. 62, No. 365A, pp. 530–532.) The adsorption of oxygen ions during the evaporation of semiconducting substances and after the deposit has been formed is an essential condition for the production of photoconductive layers. A qualitative theory based on experimental results is proposed. See also 1102 of April.

621.385.001.4 **3579**

Modern Test Methods revealing the Characteristics and Limitations of V.H.F. and U.H.F. Valves.—Remillon. (*See* 3489.)

621.385.029.63/.64 + 621.396.615.141.2 **3580**

On the Interaction between an Electron Beam and Travelling Electromagnetic Waves.—W. Kleen. (*Elektron Wiss. Tech.*, Sept. 1949, Vol. 3, No. 9, pp. 341–349.) A concise account of the theory, construction and properties of the travelling-wave valve. Interaction in the magnetron is also considered.

621.385.029.63/.64 **3581**

Investigations of Self-Excited Oscillations in Travelling-Wave Valves.—H. Schnitger & D. Weber. (*Frequenz*, July 1949, Vol. 3, No. 7, pp. 189–195.) Well-defined powerful oscillations of wavelength 5–50 cm were obtained in ordinary travelling-wave valves without any external circuit connections. Oscillation regions were established whose mean wavelength increased with the applied voltage. Within an oscillation region the wavelength falls slightly with decreased voltage; for $\lambda = 24.6$ cm the frequency variation is about 50 kc/s per volt. The results are discussed with reference to Pierce's theory (2284 of 1947). Research with valves having the spiral outside the glass wall of the tubular portion shows interesting possibilities.

621.385.029.63/.64 : 621.396.645 **3582**

The Double-Stream Amplifier.—A. V. Hollenberg. (*Bell Lab. Rec.*, Aug. 1949, Vol. 27, No. 8, pp. 290–292.) See 2487 of September.

621.385.029.63/.64 : 621.396.645 **3583**

Double-Stream Amplifiers.—Pierce. (*See* 3387.)

621.385.029.63/.64 : 621.396.65 **3584**

Travelling-Wave Amplifier for 6 to 8 Centimetres.—D. C. Rogers. (*Elect. Commun.*, June 1949, Vol. 26, No. 2, pp. 144–152.) A review of the development work which demonstrated the usefulness of the travelling-wave valve as an unattended repeater-amplifier in a microwave communication link. Valves with higher output for the power stages and with lower noise factor for the input stages still need to be developed.

621.385.032.21 **3585**

Thermionic Emission from Sintered Cathode of Thoria and Tungsten Mixture.—H. Y. Fan. (*J. appl. Phys.*, July 1949, Vol. 20, No. 7, pp. 682–690.) An experimental investigation for a cathode sintered from a mixture of 67% thoria and 33% tungsten. Emission was found to be somewhat lower than that of cathodes sintered from pure thoria. Change of cathode activity with temperature was studied in detail, and a satisfactory theoretical explanation is given.

621.385.032.213 **3586**

Potassium-Activated Cold-Cathode Tubes.—A. L. Chilcot & F. G. Heymann. (*J. sci. Instrum.*, Sept. 1949, Vol. 26, No. 9, pp. 289–294.) For most applications of cold-cathode valves, uniformity of characteristics between large numbers of valves of the same design, and for individual valves over long periods of time, is important. This uniformity depends upon accurate reproduction of (*a*) filling-gas pressure, (*b*) electrode spacings, (*c*) the cathode surface. The results obtained for a diode with nickel electrodes,the cathode being coated with potassium, are shown graphically ; the curve for clean potassium is accurately reproducible ; the contaminating effect of oxygen and water vapour is shown. The leads for the cathode and for the other electrodes of these valves are brought out at opposite ends of the glass envelope ; otherwise a conducting potassium film between different electrodes is difficult to avoid. Design details for various types of valve are given and applications are discussed.

621.385.032.216 **3587**

Oxide Cathode Theory.—W. Couch. (*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 190..198.) Brief discussion of the mechanism of activation. See also 1028 of 1940 (Blewett).

621.385.032.216 **3588**

Reversibility of Oxygen Poisoning in Oxide-Cathode Valves.—G. H. Metson. (*Nature, Lond.*, 24th Sept. 1949, Vol. 164, No. 4169, pp. 540–541.) The total emission recovered its initial value after three successive poisonings by oxygen sufficient to reduce emission by over 90%. When a diode was arranged so that the polarity of the anode voltage could be reversed instantaneously, recovery was found to be much more rapid while current was passing through the cathode than when current was not passing. A cathode is more resistant to poisoning at higher current densities. Gas pressure inside the valve increases during recovery.

621.385.032.216 **3589**

Note on Volt-Dependent Poisoning Effects in Oxide-Cathode Valves.—G. H. Metson. (*Proc. phys. Soc.*, 1st Sept. 1949, Vol. 62, No. 357B, pp. 589–591.) Cathode poisoning can be due to bombardment by electrons with certain discrete energies. Possible explanations of such poisoning at electron energies of 5.56, 10 and 15.9 eV are given.

621.385.032.216 **3590**

D.C. and Pulsed Emission from Oxide Cathodes.—D. A. Wright. (*Proc. phys. Soc.*, 1st June 1949, Vol. 62, No. 354B, pp. 398–400.) Continuation of 2091 of July. Further investigations are reported on the drop in emission with time under continuous d.c. operation. The effect is shown to be due to gas poisoning by ions returning from the anode or the anode/cathode space to the cathode. The results support the view that pulsed emission is derived by thermal ionization of absorbed Ba, as in de Boer's theory.

621.385.032.216 **3591**

On Barium-Sulphide Layers on Oxide Cathodes and their Influence on the Emission.—H. A. Stahl. (*Schweiz. Arch. angew. Wiss. Tech.*, Nov. 1948, Vol. 14, No. 11, pp. 337–343.) Electron-diffraction diagrams reveal the presence of BaS in oxide-cathode layers prepared from $BaCO_3$ or from carbonate mixtures. The sulphur is probably derived from sulphurous constituents of the atmosphere. Emission measurements show that the presence of BaS has a deleterious effect. It appears possible that differences in the performance of individual valves of the same type may be due to the existence of BaS in differing amounts in the coatings of their cathodes.

621.385.032.216 **3592**

Use of Radioactive Elements for investigating the Behaviour of the Alkaline-Earth Metals of Oxide Cathodes.—J. Beydon, L. Beaudoin, J. Challansonnet & J. Debiesse. (*C. R. Acad. Sci., Paris*, 1st Aug. 1949, Vol. 229, No. 5, pp. 353–354.) The volatilization of the oxides covering the cathodes was studied by incorporating in these oxides radioactive Ba^+ and Sr^+, and measuring with a G-M counter the activity obtained on the different electrodes of the EL3 valves used, at various stages of their operation. The loss of Ba and Sr from the cathodes occurs largely during their formation and activation.

621.385.032.216 **3593**

Influence of the Density of Emission on the Life of Oxide Cathodes.—S. Wagener. (*Nature, Lond.*, 27th Aug. 1949, Vol. 164, No. 4165, pp. 357–358.) Cathode life is not prejudiced by a considerable increase of emission density, provided ionization within the valve is prevented. Experimental results are discussed.

621.385.032.216 : 621.315.59 **3594**

Semi-Conducting Properties in Oxide Cathodes.—Hannay, MacNair & White. (*See* 3444.)

621.385.032.216 : 621.317.79 **3595**

A New Emission Microscope for Oxide Cathodes.—Jacob. (*See* 3486.)

621.396.615.14 **3596**

On the Generation of Electromagnetic Oscillations in a Spiral by an Axial Electron Current.—B. B. van Iperen. (*Philips Res. Rep.*, Feb. 1949, Vol. 4, No. 1, pp. 20–30.) The exchange of energy between an electron and an alternating electric field is analysed mathematically. The theory is applied to the interaction of a current in a spiral with an electron stream flowing along the axis, conditions for oscillation being deduced. Experimental results are in agreement with the theory. See also 893 of 1948 (Fremlin et al.).

621.396.621.53 : 537.311.33 : 621.315.59 **3597**

A Crystal Tetrode Mixer.—R. W. Haegele. (*Sylvania Technologist*, July 1949, Vol. 2, No. 3, pp. 2–4.) Construction details are given. The conversion transconductance is equal to that of mixer valves and operation is satisfactory at frequencies up to 200 Mc/s. The isolation of the input circuit is better than with diode or triode mixers. See also 3598 below.

621.396.621.53 : 537.311.33 : 621.315.59 **3598**

Crystal-Tetrode Mixer.—R. W. Haegele. (*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 80–81.) For another account see 3597 above.

621.396.645 : 537.311.33 : 621.315.59 **3599**

On the Hole Current in the Germanium Transistor.—K. Lehovec. (*Phys. Rev.*, 1st April 1949, Vol. 75, No. 7, p. 1100.)

621.383 + 621.397 **3600**

Photoelectricity and its Applications. [Book Review]—V. K. Zworykin & E. G. Ramberg. Publishers: J. Wiley & Sons, New York, 1949, 494 pp., $7.50. (*Electronics*, Oct. 1949, Vol. 22, No. 10, pp. 250, 252.) " This book covers virtually the entire field of photoelectricity from its historic beginning to its recent application in Ultrafax."

621.385.832 **3601**

Cathode Ray Tube Displays. [Book Review]—T. Soller, M.A. Starr & G. E. Valley, Jr (Eds). Publishers: McGraw-Hill, New York & London, 1948, 746 pp., 60s. (*Nature, Lond.*, 8th Oct. 1949, Vol. 164, No. 4171, pp. 594–595.) Vol. 22 of the M.I.T. Radiation Laboratory series. A very comprehensive treatment of the principles of operation of the c.r. tube and its use for displaying various types of radar and other information. A chapter on screen materials is included.

621.396.615.142 **3602**

Modern Radio Technique. [Book Review]—A. H. W. Beck. Publishers: Macmillan, New York, 1948, 173 pp. (*Proc. Inst. Radio Engrs, W. & E.*, Sept. 1949, Vol. 37, No. 9, p. 1038.) The operation of v.m. valves is described, with considerable attention to design.

MISCELLANEOUS

621.39 : 061.3 **3603**

The International Conference of the Union Internationale des Télécommunications.—A. Möckli. (*Bull. schweiz. elektrotech. Ver.*, 4th Sept. 1948, Vol. 39, No. 18, pp. 607–612. In French, with German summary.) The objects and the organization of the Union are explained; a brief review of the work of individual conferences and committees shows the immense progress in international collaboration realized in recent years. The great technical and linguistic difficulties which complicate the work of international conferences are discussed and the way in which these difficulties are overcome by good organization and technical measures is outlined. A short report of the results of the conferences at Atlantic City is included.

621.396 **3604**

Outline of Radio. [Book Review]—Publishers: G. Newnes, London, 21s. (*Engineering, Lond.*, 5th Aug. 1949, Vol. 168, No. 4358, p. 144.) " This volume, of nearly 700 pages, has been compiled by a team of eight contributors, and describes in simple terms the electrical phenomena and principles upon which are founded the allied techniques of radio, television and radar."

ABSTRACTS AND REFERENCES INDEX

The Index to the Abstracts and References published throughout the year is in course of preparation and will, it is hoped, be available in February, price 2s. 8d. (including postage). As supplies are limited our Publishers ask us to stress the need for early application for copies. Included with the Index is a selected list of journals scanned for abstracting, with publishers' addresses.

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